VOLUME 40
NUMBER 8

AUGUST, 1953

plating

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FIRST SESSION PAPERS

See Contents Page 857

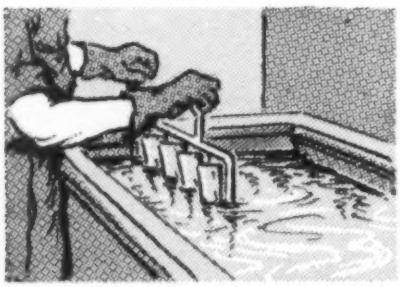
Troubled with **RUST?**

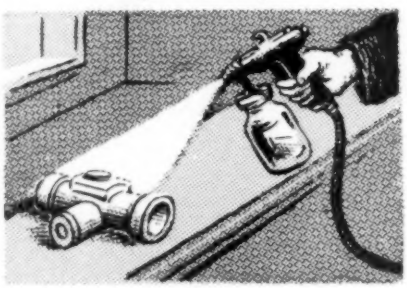
DURING PROCESSING,
IN STORAGE, OR
ON FINISHED PARTS.

Then you need

CLEPO DUXBAK "S"

Just Dip or Spray





Simple to use...

Merely dip parts in or Spray with, Duxbak "S" Economical. Can be used at full strength or diluted. High protection for many months on most delicate and sensitive steels. Used on wet or dry parts. Easily removed for further processing.

✻ WRITE FOR LITERATURE

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REMOVE RUST FAST WITHOUT ACIDS!

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ALKALINE DERUSTING COMPOUND 134

An electrolytic process operated at room temperature that enables the following to be done

1. Reclaim and derust valuable bearings, tools, dies and gages.
2. Clean and renew rusty mechanisms without disassembly or harm to tolerances, delicate components, or non-ferrous metals.
3. Clean and pickle all types of steel, cast iron and malleable iron for finishing operations.
4. Reduce costs on heat treated, forged, or cast parts by descaling prior to subsequent machining or processing.
5. Replace shot or sandblasting for scale removal.
6. Clean and brighten automotive and airplane parts.
7. Salvage iron and steel parts rusted by fire or flood.
8. Remove oil quenching scale and smut electrolytically in bulk.

Write for bulletin describing the many features of this new Alkaline Derusting Process.

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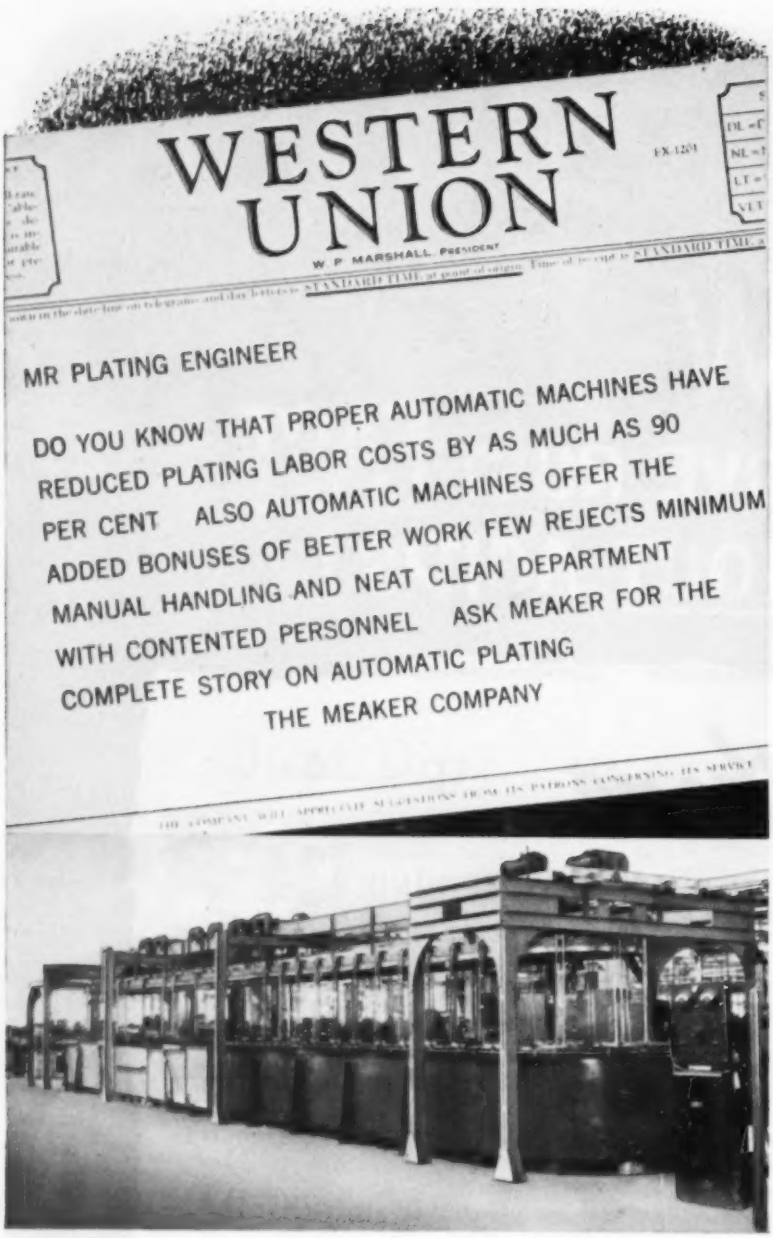
ELECTROPLATING CHEMICALS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MR PLATING ENGINEER
DO YOU KNOW THAT PROPER AUTOMATIC MACHINES HAVE REDUCED PLATING LABOR COSTS BY AS MUCH AS 90 PER CENT ALSO AUTOMATIC MACHINES OFFER THE ADDED BONUSES OF BETTER WORK FEW REJECTS MINIMUM MANUAL HANDLING AND NEAT CLEAN DEPARTMENT WITH CONTENTED PERSONNEL ASK MEAKER FOR THE COMPLETE STORY ON AUTOMATIC PLATING
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Special Machines for the Unusual Requirements

4454

In This Issue

Iron Plating From an Alkaline Bath by Edward F. Foley, Jr., Henry B. Linford, and Walter R. Meyer is a paper in which an alkaline iron electroplating solution is described. The solution consists essentially of ferric ion together with sodium hydroxide, triethanolamine, and the sodium salt of ethylenediamine tetra-acetic acid. Data are given on the effects of these variables on cathode efficiency and operating characteristics.

Statistical Quality Control—A New Tool for the Electroplater by Ezra A. Blount. Statistical quality control, originated some thirty years ago as a method of inspection through scientific sampling to control quality in the mass production of machine parts to close tolerances, has been applied recently in the electroplating and finishing industries to control process variables such as solution composition, *p*H, and also to record and control the percentage of rejected parts.

Bright Gold Plating by Edwin C. Rinker is a paper which describes a recent development in the precious metal electroplating field. The cyanide bath in this process utilizes brighteners which are inorganic complexes of noble metals. Bath operating conditions and physical properties of bright-gold deposits are compared with conventional gold electroplate.

A Corrosion Study of Various Chromium Plated Electrodeposits by H. Brown and E. W. Hoover is a paper in which corrosion results in salt-spray, humidity and outdoor exposure tests are presented for various coatings which are cathodic to steel. These include nickel, nickel-cobalt, nickel-iron, copper, chromium, gold and rhodium in various combinations.

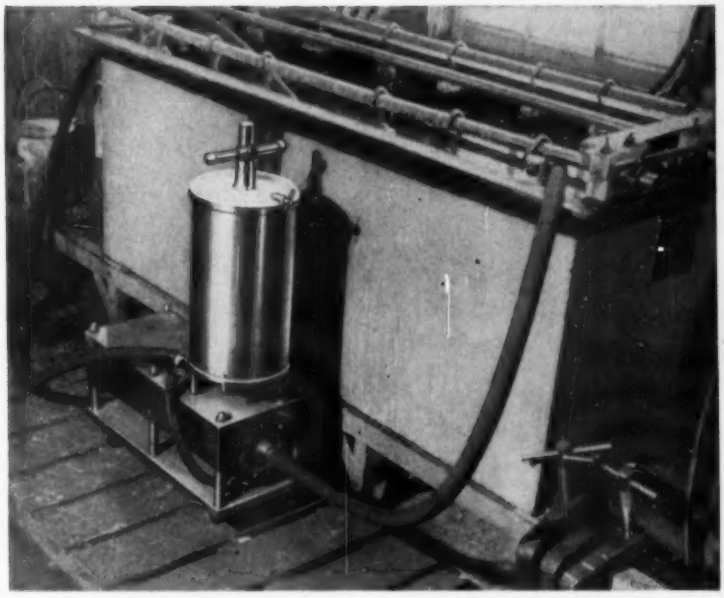
Current and Metal Distribution in Electrodeposition. III. Experimental Determination of Metal Distribution by John Kronsbein. This paper, the final report to be submitted by Project 11, presents data obtained by measuring the metal distribution on the interior surfaces of right angle specimens of various shank lengths and fillet radii when plated in a specially designed shielded box at 2 average current densities in 3 different solutions.

For page numbers, see Table of Contents, page 857

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year, $1.00 per copy.

Here's how to cut your losses

get better finished plated work — save time and labor



The "Sealed-Disc" Filter will remove all dirt, dust, and sludge from your plating solutions. You'll no longer worry about pitting, spotting, poor adhesion, formation of nodules, etc.

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Industry News

Wyandotte Chemicals Opens New Research Laboratories. Opening of Wyandotte Chemicals' new 74,800 square foot research laboratories building went off as scheduled. The Michigan corporation's research "teams", which have as their aim "Wyandotte betters today and looks to tomorrow", are now operating "in high gear".

Contained in the new Wyandotte Laboratories building, which has been designated by impartial observers as the finest research facility in the industry, are: facilities for studying metal finishing operations which include an exclusive plant-size, power spray washer capable of duplicating almost every commercial operating cycle in use in North American manufacturing plants; a nucleonics laboratory where soils are tagged with radioactive tracers and the efficiency of various cleaning operations is measured with Geiger counters; and two wings of organic and analytical laboratories, a library containing over 7,000 volumes and regular issues of 175 technical magazines, patent department, an auditorium seating 150 persons, an unique arrangement for distributing utilities and special services, and a 375-ton air conditioning installation which makes it possible to heat or cool any area as desired.

Marketing Activities Change. The McAleer line of products is now back in the hands of its original owner, C. H. McAleer, President of Detroit Chemical Specialties, Inc.

McAleer

A complete line of McAleer products, including liquid polishes, waxes, polishing and buffing compounds for the plating industry, rubbing compounds, and other chemical specialties, will be sold nationally direct to the trade and through distributors.

The McAleer Manufacturing Company was organized 30 years ago. McAleer sold his interests in 1940, then returned to the field in 1946, when he founded Detroit Chemical Specialties, Inc., with the "De-

HERE'S WHY
the sensational
SelRex Bright Gold Process
IMPROVES QUALITY
. . . with LESS GOLD

The chart below shows the comparative facts between conventional and SEL-REX golds as confirmed by an independent testing laboratory. At last it is now practical for manufacturers to use gold to improve quality and appearance . . . at little cost . . . for SEL-REX gold produces a hard, mirror-like deposit, regardless of thickness, without scratch brushing or buffing.

- Extra Hard
- Brighter and Smoother
- Excellent Metal Distribution
- More Economical
- Room Temperature Operation
- No Special Equipment to Operate

TEST	CONVENTIONAL GOLD	BRIGHT GOLD	RESULT
SMOOTHNESS Profilometer Test Gold Thickness .0005"	Before plating: 1.5 micro-inches R.M.S. After plating: 8.0 micro-inches R.M.S.	Before plating: 1.5 micro-inches R.M.S. After plating: 1.5 micro-inches R.M.S.	BRIGHT GOLD gives exact duplication of the surface plated—does not deform or alter contour. Requires no scratch brushing or buffing.
HARDNESS	Tukon Hardness Converted to Vickers Scale – 65 Knoop Hardness – 47.54	Tukon Hardness Converted to Vickers Scale – 115 Knoop Hardness – 85.51	Less BRIGHT GOLD is required to give greater protection against wear, galling and corrosion.
METAL DISTRIBUTION Thickness Measurement Gold Thickness .001"	Distribution ratio 4 to 1 Edge to Dead Center	Distribution ratio 1.5 to 1 Edge to Dead Center	Less BRIGHT GOLD is required to secure minimum specified thickness. Throws well into deep recesses and blind holes.
ABRASION TEST Experimental Taber Abraser-CS 10 Wheels 500 gram load	Initial breakthrough 2,400 revolutions Exposure after 9,000 revolutions— more than 40%	Initial breakthrough 3,300 revolutions Exposure after 9,000 revolutions— less than 10%	BRIGHT GOLD gives 40% more protection against wear and abrasion.
SIMPLICITY OF OPERATION	High temperature 140° F.–160° F.	Room temperature 55° F.–75° F	BRIGHT GOLD bath does not deteriorate, and is easier to control and maintain.

Send for a trial order of 1-ounce today
Manufacturers of SEL-REX Silver Sol-U-Salt, Gold and Rhodium
SEL-REX PRECIOUS METALS, INC.
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If you are looking for a future, age no limit, small shop, at present 3 polishers employed, Silver, Gold and Chromium.

Ace Electro Plating Wks.
2655 6th Ave. So.
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Joseph S. Linn—owner

A 3-legged stool doesn't rock

Cylinders run smooth and quiet—not even a murmur—there's nothing like BELKE 3-point suspension.

BELKE Multiple Barrel Unit featuring—

- *Three-point Barrel Suspension.*
- *High Temperature Lucite Cylinders.*
- *Heater Coil Equipped Tank.*

Patent Pending

Over-night

3-point Suspension Plating Barrels have come into nationwide demand

No matter how accurately 4-point suspension barrels may be machined and levelled, wear and moving from one set of saddles to another develops inaccuracies. The cylinders soon begin to rock and wobble, causing bumps and strains that shorten cylinder life—and increased wear to hanger studs, gears and saddles. Just look at your own plating barrels.

Cameras and surveying instruments are supported by tripods because they must be rigid; 3-point support or 3-point suspension prevents rocking or wobbling regardless of the surface. BELKE 3-point Suspension Barrels run smooth, no bumps, no rocking, no wobbling.

Three-point suspension is so simple a child can see it is the one right way to make plating barrels—yet it took us 25 years to discover this great improvement. Now we can't make 3-point suspension barrels fast enough.

Send for literature or ask your BELKE Service Engineer.

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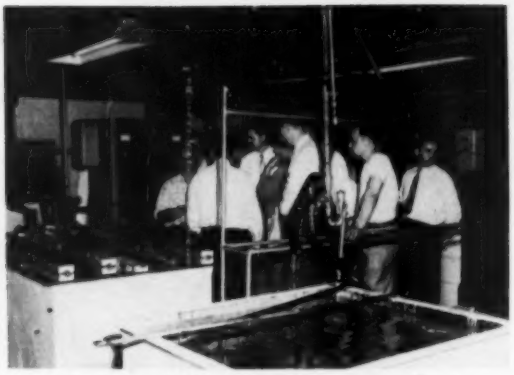
EVERYTHING FOR PLATING PLANTS

troit" line of polishing and buffing compounds and allied products.

The company, located at 101 S. Waterman, Detroit, will continue with this line, along with the McAleer line.

Belke Scholarships Repeated. A wonderful opportunity is offered to young men with ability and an interest in Chemical Engineering. As yet, however, this opportunity has not become too well known to members of the plating industry, so it is with this in mind that the following information about the Belke Scholarships is supplied.

To stimulate interest in the plating industry the Belke Scholarships are offered to capable young men who are interested in the profession.



Students of the Illinois Institute of Technology class for electroplaters tour the plant of Arrow Plating Company, Chicago. The class is led by Joseph M. Andrus, Superintendent of Finishing, Croname, Inc., who is President of the Chicago Branch, American Electroplaters' Society

Two full-tuition five year scholarships for the Northwestern University Technological Institute have again been granted by the company for students entering this fall.

The University's cooperative program alternates college work with actual work periods in industry over a five year program for the degree of Bachelor of Science in Engineering.

The scholarships cover tuition for the five year period. The student receives the prevailing wage scale for the industrial work periods, which enables him to be very near self-supporting.

Upon enrollment, students attend college one and one-half years, then alternate between twelve week periods in industry and twelve week periods in college covering Mathematics, Chemistry, Physics, Mechanical and Electrical Engineering, and other allied subjects.

The periods in industry include work at the Belke plant, at other plants that manufacture plating equipment and in the plating departments of manufacturers, as well as job plating shops.

Admission requirements of the Northwestern University Technological Insti-

PRE-CLEAN for a Physically Clean Surface

Remove ALL dirt... buffing and polishing compounds, chips, drawing compounds, etc., in a thorough, one-step cleaning operation that gives you a *physically* clean surface. For practically all finishing operations except plating and vitreous enamelling, this physically clean surface is adequate. If you plate or enamel, you need a final cleaning operation to get a *chemically* clean surface. But good pre-cleaning greatly simplifies and speeds up the final cleaning stage in alkaline or in electrocleaning baths.

PRE-CLEAN for Solid Dirt as well as Oil and Grease

If there's solid dirt on the work, you can't depend on degreasing alone to remove embedded or stubbornly bonded particles. You have to have something more than solvent action on oil or grease. And that's exactly what the Magnus Emulso-Dip Pre-cleaning method provides.

PRE-CLEAN without Fumes and Corrosion

The Magnusol cleaning solution used in this method does not generate unpleasant or toxic fumes. It has no corrosive or harmful action on any metal. And it gives you the most economical cleaning that exists today.

ASK FOR A PRE-CLEANING DEMONSTRATION . . . either in your plant or in the Magnus Pilot Laboratory.

magnus

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ELECTRO OR INORGANIC CHEMIST

Permanent position in research laboratory of growing and well established New England manufacturer of metal finishing compounds. Must have an MS degree or equivalent. Experience desired but not necessary. Must be capable of conducting supervised research on new developments for the electroplating industry. Liberal insurance, vacation and retirement benefits. Compensation for moving arranged. Salary open. Send full details in first letter. *Reply to:*

P-853-A, PLATING
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There is only ONE LEADER!

IN CADMIUM BRIGHTENERS IT IS

ROHCO® 20XL!

POWDER LIQUID

CHECK THESE POINTS:

1. Proved in over 5 years of use.

2. Such remarkable throwing power that frequently up to 40% of cadmium metal is saved by plating recesses to specification thickness without excessive buildup on external areas of work.

3. Such amazing covering power that many times inside anodes are eliminated to cover and plate recesses.

4. Maximum brilliance of deposit, greatest possible ease of control of the bath and widest plating range combine to make ROHCO 20XL the outstanding brightener. There just isn't anything like ROHCO 20XL—ask the man who's using it! ROHCO 20XL is the original liquid brightener—for ease of addition, but also available in powder if you prefer!

R. O. HULL & COMPANY, Inc.

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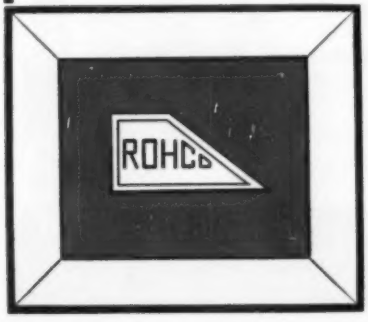

JUST PIN THIS COUPON TO YOUR LETTERHEAD!

R. O. HULL & COMPANY, INC.
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Please send details on ROHCO 20XL CADMIUM BRIGHTENER!

Name..... Title.....

Company.....

Street Address.....

City..... Zone..... State.....

Industry News

tute include average high school grades in the upper quarter of the class, with three and one-half units of high school mathematics.

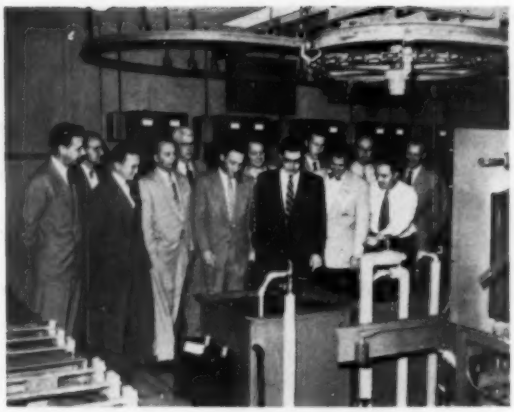
Further information will be supplied promptly on request to Raymond W. Kotz, Belke Manufacturing Company, 947 N. Cicero Ave., Chicago 51, Ill.

New Facilities for Diamond Alkali. More extensive, centralized storage and handling facilities to serve Diamond Alkali Company customers in New Jersey, New York and surrounding areas have been completed and are now in operation at the company's Jersey City silicate plant.

In line with Diamond's continuing policy of increasing customer service, the new construction provides 24,000 additional square feet of storage space for packaged chemicals. It consists of a steel frame-transite siding structure 200 feet long by 120 feet wide. A masonry wing, 21 feet by 52 feet, attached to the east end, houses the employees' locker room, lunch room, service quarters and office.

Use New Research Labs as Classroom for Wyandotte Training Course. Ten more Wyandotte Chemicals Industrial Representatives recently completed a week-long training course at the home office in Wyandotte, Mich.

Shown in the photo is the most recent class studying electroplating and cleaning operations in the new 18-tank installation in Wyandotte's recently opened research laboratories building.



The Wyandotte men, including three from the home office, are left to right: R. J. Racine, manager Industrial Sales; P. N. Burkard, manager Industrial, Railroad and Aircraft Detergents; E. H. Rollfs, Boston; E. J. Roach, Philadelphia; H. F. Fulton, Buffalo; A. J. Medwedeff, Detroit; A. L. Morshauser, Cincinnati; T. S. O'Donoghue, Chicago; K. W. Clayton, Los Angeles; S. Peek, Cleveland; F. F. Roberson, Detroit; A. W. Liger, Supervisor Industrial Research, and W. T. Kiernan, San Francisco

AVOID COSTLY REJECTS DUE TO UNACCEPTABLE COATING THICKNESS!

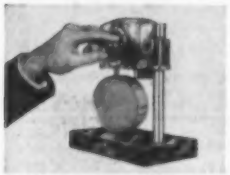
For quality control and acceptance tests, measure thickness of coatings on metals the easy, accurate, non-destructive way, with the . . .

AMINCO BRENNER **MAGNE-GAGE**

Widely used by industry and government for accurately measuring the thickness of:

1. Non-magnetic coatings (metallic or non-metallic) on magnetic base metals.
2. Nickel coatings on magnetic or non-magnetic base metals.
3. Composite copper-nickel coatings on magnetic base metals.

Measures coatings on plane, convex or concave surfaces. Gives speedy and accurate results. Easy to use by non-technical personnel.



Coating on cylindrical object being measured with the Magne-Gage.

Avoids expensive rejections due to coatings that may be too thin, or non-uniform. Eliminates the expense involved in replating or discarding specimens spoiled by destructive tests . . . every piece tested is unharmed and ready for use or shipment. Saves materials wasted by coatings thicker than necessary. Its use leads to the discovery of faults that may exist in plating methods or equipment.

Write for Bulletin 2150–Y

AMINCO *Laboratory Instruments*

AMERICAN INSTRUMENT COMPANY, INC.

Silver Spring, Maryland • In Metropolitan Washington, D. C.

Bright Silver

LEA-RONAL

Another member of the
LEA-RONAL Bright Plating
Process Team rapidly gaining
wide and enthusiastic acclaim.

Silver

PRODUCES MIRROR BRIGHT / FINISH

You know now of the great success of LEA-RONAL Bright Copper, utilizing Lea Copper Glo. This silver finish is a worthy member of the same team, fully proved in production for still and barrel plating.

If you are working on Silver Plating, investigate the merits of the LEA-RONAL Bright Silver process. Standard silver plating baths can be easily converted.

- Directly from the tank
- Wide current density range (5-40 amperes/sq. ft.— Hull cell range)
- Room temperature operation
- 100% efficiency
- Stable brighteners
- Crystal clear solutions
- Sodium or potassium formulation
- Exceptional throwing power
- Works with direct, P. R. or interrupted current
- Ideal surface for butler finishing

BRIGHT COPPER	SUPERTARTRAL
BRIGHT SILVER	CUPRALL
BRIGHT GOLD	WETTING AGENT CW-6
NICKEL-GLO	WATERSHED
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BRIGHT CADMIUM PROCESS

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•

Sales Office and Plant
East Aurora Street, Waterbury 20, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 900.

Industry News

Enthone Annual Spring Sales Meeting. Attending the annual spring sales meeting of Enthone, Inc., New Haven, Conn., were the organization's representatives from Cleveland, Chicago, and Los Angeles as well as those from the Eastern Seaboard and New England states. The meeting, which was held over a two-day period at Lakeville, Conn., was also attended by two representatives of R. O. Hull & Company, Cleveland, Ohio.

"King Size" D-C Power Source. Completion of a single cubicle selenium rectifier with an output capacity of 30,000 amperes of d-c power at 12 volts, and occupying only 96 square feet of floor space, has been announced by Bart-Messing Corporation, of Belleville, N. J. The rectifier, largest single cubicle unit ever built, is being installed in South Portland, Maine, where it will be used to furnish low voltage d-c power for electroplating of nickel-lined steel pipe for Atomic Energy Commission projects.

To eliminate costly maintenance, the huge rectifier is completely sealed and gasketed for protection against the corrosive atmosphere commonly found in plating plants. An air-to-water heat exchanger will cool the unit with air recirculated within the cabinet. An interior temperature of 95° F will be maintained regardless of outside conditions.

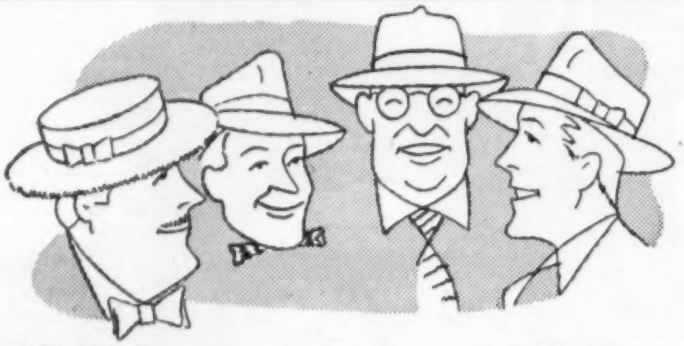
Mr. E. K. Faulman, Naraco's Board of Directors President, announced the consolidation of Imperial's Hazel Park and Flint, Mich., plants. Personnel and machinery from both these plants have moved to a larger location at 1109 E. Stewart Ave. in Flint, Mich.

Imperial's new plant, now in operation, has over twice the square feet capacity of both previous plants combined and its facilities include many of the latest up-to-date rack and conveyor rack making equipment. Among the new equipment installed is a huge specialized tank for applying Naraco's own insulation to oversized parts and equipment. The building also houses modern offices for Naraco's engineering staff.

Tornado Damaged Norton Rebuilding. Shortly after the disastrous tornado which killed 87 people and did damage estimated at $59 million in the Worcester, Mass., area, emphasis shifted from rescue and salvage operations to rebuilding. Norton Company, whose new grinding machine plant suffered damage estimated at over a million dollars, has just come through the greatest ordeal of its 68 years in business.

The new plant, which was directly in the path of the twister, is now beginning to resemble its former trim and modern self. Debris has been cleaned from the area and machines are again busy on the production lines. The office is back to normal except that some of the papers and records are missing, victims of the wind. One manufacturing change order was picked up 35 miles away and returned by the finder.

Fall Schedule of School of Spray Painting. The schedule for the latter half of 1953 has been announced by the DeVilbiss Company for courses of instruction in industrial spray finishing methods in its School of Spray Painting at Toledo, now in its twenty-seventh year of tuition-



All salesmen are not engineers!

Unlike salesmen with the single ambition to sell more goods, Sales Engineers analyze customers' problems, make expert recommendations, see the job through.

Klem has no salesmen—just Sales Engineers supported by lab facilities that duplicate any production condition to assist them in solving problems.

Place your tough job in the hands of a Klem man. The assignment will be followed. The sale will be regarded as made only when the product furnished is doing the job you want done.

3 OF 20 STANDARD KLEM PRODUCTS

KLEM KOTE—Cleans, conditions ferrous metals and aluminum surfaces—imparts a phosphate coating for better paint adhesion. Non-toxic, requires no special handling precautions

KLEM KLEANER No. 144—Rapid, thorough, heavy duty still tank cleaner for ferrous metals. Removes the most difficult soil

RUST-SOL No. 124—Concentrated phosphoric acid surface cleaner. Removes oil and rust. Provides slight etch to promote paint adhesion. Meets USA 3-213, TAC-ES431 and MIL-C-10578

KLEM PRODUCT of the MONTH

Klem Water Wash Compound No. 203

Reduces Spray Booth maintenance costs, keeps circulation lines, water pumps, nozzles and baffles free of paint sludge. No 203 floats the paint, makes reclaiming of paint easier. Write for details

KLEM Chemicals Inc.
14481 LANSON . . . DEARBORN, MICHIGAN

Gun polishing with Norton ALUNDUM abrasive. This man has the "Touch of Gold." His work is fast, precise and low in cost. Uniform-sized grain means better quality finishes.

High capillarity Norton ALUNDUM abrasive soaks up water in test; does the same with glue on the job . . . assuring stronger, faster-cutting polishing wheel.

Polish with the

"TOUCH OF GOLD"

You get the right combination for fast and profitable work in Norton ALUNDUM Abrasives*

Every *grain* of Norton ALUNDUM polishing abrasive does its full quota of work! That's one reason your operators get the "Touch of Gold" that adds to the appearance and quality of your product . . . increases your profit margin, too.

You get better polishing at lower cost with ALUNDUM abrasive because each grain is identical with the next . . . hard, tough, long-lived and exact as to size and shape. No oversize grains to mar surfaces — no undersize grains to loaf on the job. Capillary tests show that Norton abrasive grain adheres tightly to the wheel until all its work is done. This assures better performance and longer life — greatest efficiency for you.

Fast service from your Norton distributor brings you the exact type of ALUNDUM polishing abrasive you need. He is backed by complete stocks at key industrial centers, ready for shipment in convenient container sizes . . . and by the specialized experience of Norton field engineers. Or you can write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

NORTON

ABRASIVES

Making better products to make other products better

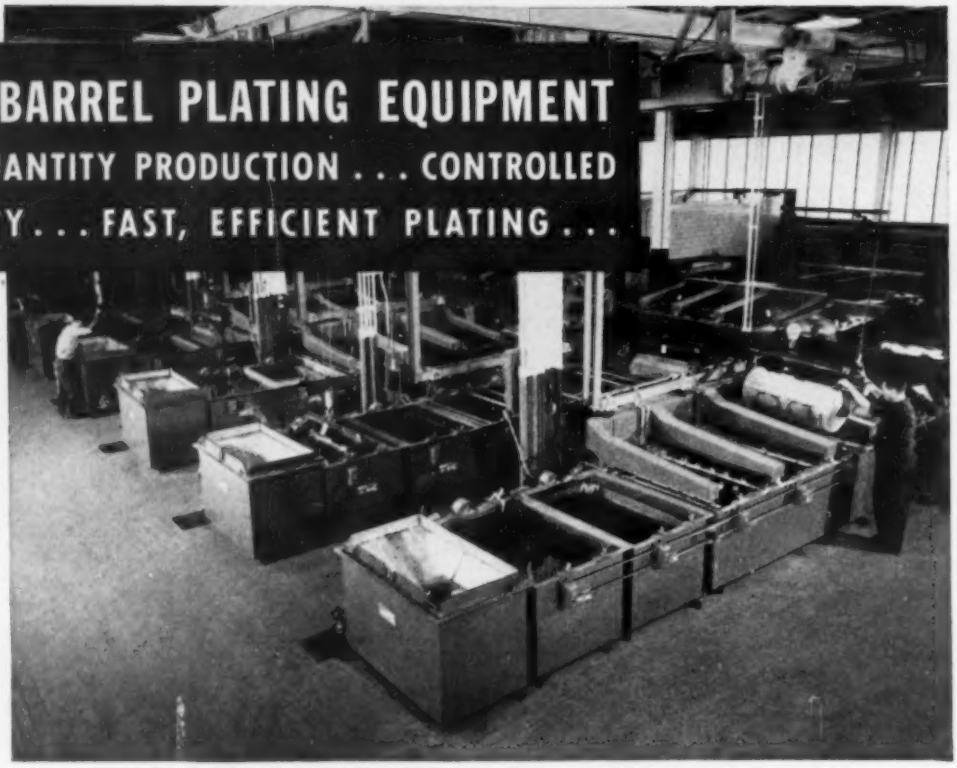
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

G-256

UDYLITE BARREL PLATING EQUIPMENT

ASSURES QUANTITY PRODUCTION . . . CONTROLLED UNIFORMITY . . . FAST, EFFICIENT PLATING . . .

at UNION SWITCH AND SIGNAL



Udylite Barrel-Plating Installation at Union Switch and Signal, Swissvale, Pa.

One of the most modern and streamlined electroplating plants in the United States . . . Union Switch and Signal, Swissvale, Pa., a division of Westinghouse Air Brake Company . . . uses barrel-plating equipment by Udylite. With this equipment, they know they'll get the plating results they're after!

Here's what Mr. Albert Beswick, Works Manager, says of Udylite barrel-plating equipment: "Union Switch and Signal and other divisions of Westinghouse Air Brake Company use millions of plated nuts, washers and screws annually. For large-volume handling of these tiny parts, we have found Udylite's barrel-plating equipment to be invaluable from the standpoint of economy and maintenance."

Why not let Udylite help you with your small parts plating problem. Whether it's a single barrel or a multi-barrel installation, Udylite has equipment tailored to your needs!

Call your Udylite Technical Man today or write direct. THE UDYLITE CORPORATION, DETROIT, MICHIGAN. *West of Rockies: L. H. Butcher Company, Los Angeles, California.*

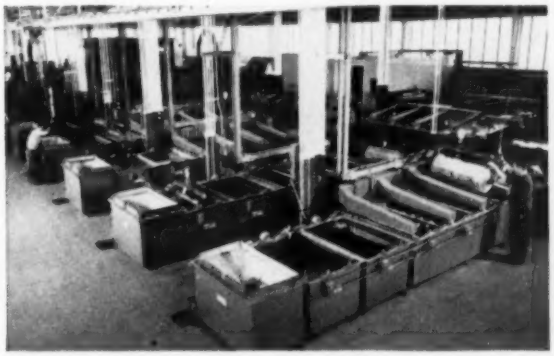
PIONEER OF A BETTER WAY IN PLATING

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

UDYLITE CYANIDE COPPER SUPPLIES ARE BEST!

The best supplies consistently produce superior results in Cyanide Copper plating. That's why the Udylite Corporation maintains complete laboratory control over all supplies! Every item bearing the Udylite name receives a rigid inspection and constant spot checks to assure uniformity and top quality.

Get the best Cyanide Copper supplies, money will buy—



Udylite barrel-plating installation at Union Switch & Signal, Swissvale, Pa. Millions of nuts, bolts, washers and small parts are processed here annually.

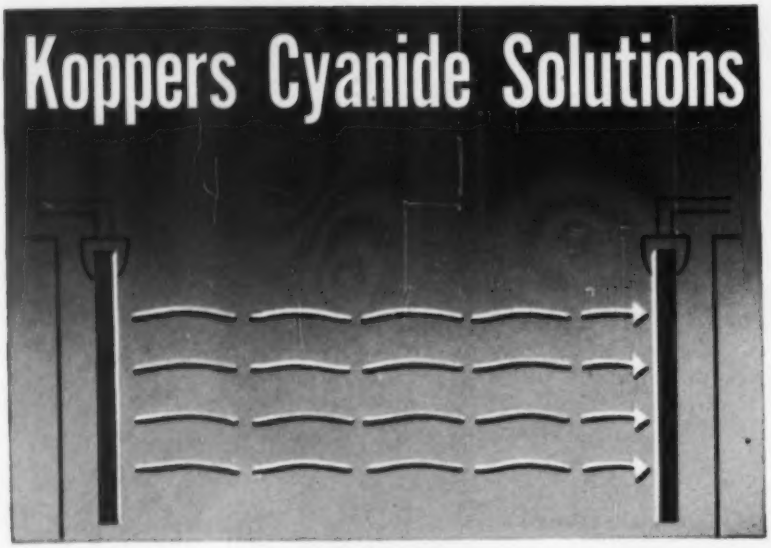
- Udylite Copper Ball Anodes—manufactured to provide maximum anode surface and area. They are long-lasting . . . there's no waste.
- Udylite Ball Anode Containers — These assure an efficient copper solution. They use anodes to the last scrap . . . are more efficient.
- Udylite Rochelle Salts — These salts undergo rigid quality control methods . . . which assures uniformity, regardless of the quantity needed.
- Udylite Cyanides — Laboratory-tested and closely controlled to conform to the high Udylite standards.

When you think of Cyanide Copper supplies, think of Udylite for availability and finest service. Call your technical representative or write direct to THE UDYLITE CORPORATION, DETROIT 11, MICHIGAN. *West of the Rockies: L. H. Butcher Company, Los Angeles, California.*

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

PIONEER OF A BETTER WAY IN PLATING

Koppers Cyanide Solutions



Make Electroplating Easier... Safer... Faster

● Koppers is pleased to offer these three convenient cyanide solutions to the electroplating field. Their availability in solution form obviates the troublesome, dangerous, and time-consuming task of handling and dissolving cyanide granules.

Potassium Cyanide, 35-40%—widely employed in electroplating where copper is used as a base coat for chromium plating. Forms soluble complexes with copper, silver, gold, cadmium, zinc, and other metals of the general form $K_2M(CN)_3$ or $K_2M(CN)_4$. Extremely low sulphur content but with high purity.

Sodium Cyanide, 26-30%—a complexing agent manufactured from high purity hydrogen cyanide, reducing to a minimum the amount of contaminating organic chemicals and inorganic salts. Extremely low sulphur content.

Barium Cyanide, 30%—suggested as a cyanide plating bath additive, particularly in cadmium plating to remove the troublesome effect of carbonates and sulfates in the bath. Combines the qualities of high purity and low sulphur content.

Potassium Cyanide is available in 55-gallon drums or tank truck quantities. Sodium Cyanide is available in tank truck and tank car quantities. Barium Cyanide is offered in 55-gallon drums. The lower price structure and safe, easy-to-use liquid form of these cyanides, make them especially desirable to the electroplater. For further details, write to:

KOPPERS®

Koppers Chemicals

KOPPERS COMPANY, INC.

Chemical Division, Dept. P-83, Pittsburgh 19, Pennsylvania

Industry News

free operation for users of DeVilbiss equipment. Applications should be made as early as possible for enrolling foremen, shop superintendents, maintenance supervisors, spray operators and any others who wish to attend the week-long classes as follows: August 17, September 14, October 12, November 9 and December 7.

Applications for all classes on the new schedule should be sent now to the De Vilbiss Company, Toledo 1, Ohio. Those interested may request School Form INS-753-A.

Silicon Process Announced. Development of a process for manufacturing pure silicon, which may lead the way to more powerful and less bulky television, radio, and other electronic and electrical equipment was made known recently by the duPont Company. By this process, the company has opened up a virtually unlimited source of the material—a nonmetallic element—for transistors which appear to be revolutionizing electronics, as well as rectifiers and probably other electrical parts. Furthermore, silicon is expected to greatly broaden the scope of these developments because it works over a much wider temperature range than other materials available.

In rectifiers, the essential electrical devices which change alternating current to direct current, silicon would compete with selenium. The ability of silicon to withstand heat and handle greater power means smaller rectifiers with more capacity. The pure silicon, as made by du Pont, is a brittle, gray, sparkling element with crystalline appearance. Its specific gravity is 2.4, which makes it a little lighter than aluminum. Output is now on a scale large enough to supply extensive research programs throughout the country.

Name Change. F. A. Weible, Jr., president, announces that the McAleer Manufacturing Company, manufacturers of McAleer products, has changed its corporate name to the Goodison Manufacturing Co., Inc.

The former company manufactured polishes, other protective maintenance and refinishing materials, and industrial buffing and polishing compounds.

The new company will manufacture industrial buffing and polishing compounds exclusively.

All products will carry the Goodison name. The company's management and personnel remain the same, and its own field organization continues to handle all sales.

Main office and plant are at 4393 Orion, Rochester (Goodison), Mich.

DEPENDABILITY...under all conditions

Sel-Rex

Completely Sealed — Water Cooled
PLATING RECTIFIERS

- *Never Needs Cleaning*
- *Absolute Protection Against Corrosion, Dirt, Moisture!*

Greater flexibility and control . . . dependable efficiency . . . these are characteristics of every Sel-Rex Selenium Rectifier.

Hundreds of major installations — more than 2,000,000 amperes of dependable D.C. power — are a tribute to the quality and efficiency of Sel-Rex Rectifiers for day-to-day-on-the-job performance under all conditions.

Before you buy any D.C. power source, be sure that it has all these features!

REACTRONICS — Completely eliminates moving parts . . . maintains constant voltage across the bus bars or constant rate of current flow through the bus bar.

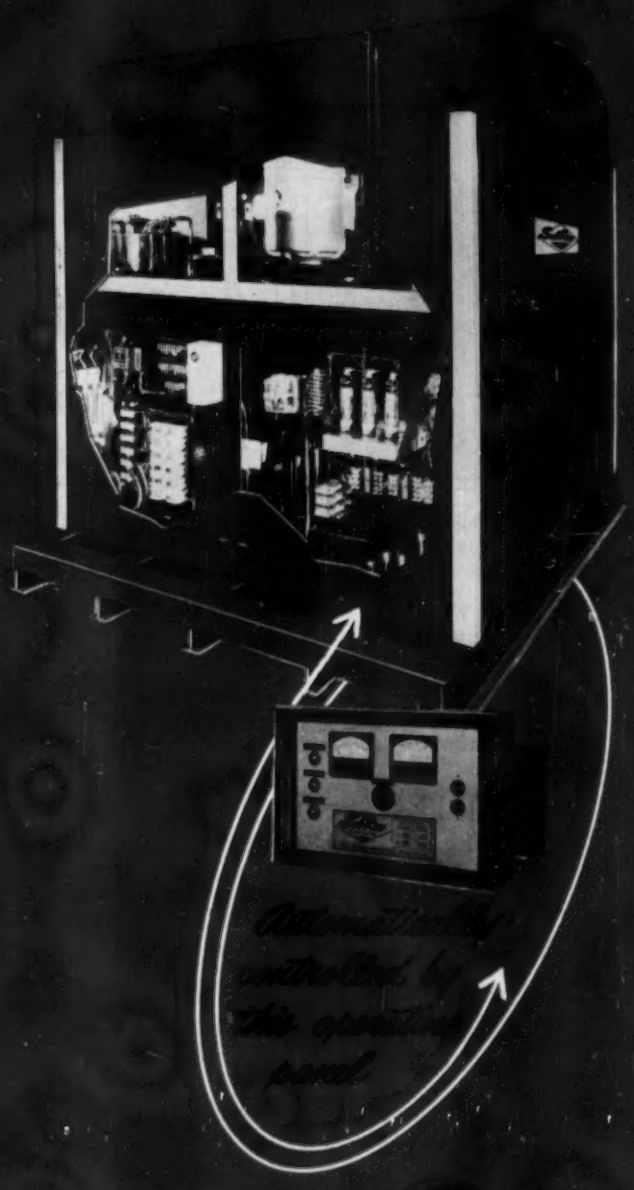
TRANSFORMER — Conservatively rated, heavy duty 3 phase, protected for use in highly corrosive atmospheres. Constructed and insulated with the finest materials.

METERS — Highest quality Weston meters, with large dials for easy, accurate reading, are standard equipment on all Sel-Rex units.

POSITIVE OVERLOAD PROTECTION — Unit shuts off automatically when output current exceeds rated value.

For absolute protection against corrosion plus the many other advantages that mean dependable, efficient D.C. power — specify Sel-Rex, the only Rectifier fully covered by a TWO-YEAR guarantee.

Write for your FREE copy of "PLATING POWER"

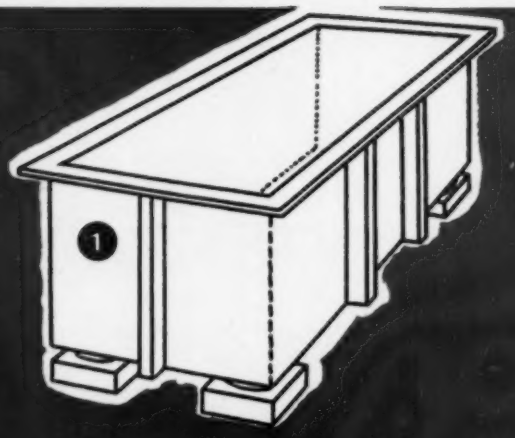


BART-MESSING CORPORATION
Dept. PL-8 229 Main Street, Belleville 9, N. J.

NEMA

A COMPLETE RECTIFIER LINE ... FROM 25 to 50,000 AMPERES

Three Simple Steps for LOWER Tank Maintenance COSTS



Whether you line your tanks with rubber, plastic, brick, tile, lead or use them unlined, here are three simple steps you can take that will assure you longer tank life, lower maintenance costs:

1. Wherever possible see that tanks are installed with adequate air space underneath, and that all exterior surfaces are accessible for cleaning.

2. Coat all exterior surfaces, including the bottom, with Tygon Corrosion-resistant Paint — the all-plastic coating resistant to acids, alkalies, oil, water and alcohols. Don't be stingy. Do the job properly. Apply a coat of Tygorust, the "no-prep" rust inhibiting vinyl primer, and three coats of Tygon Paint.

3. Clean and inspect the outside shell occasionally. The glossy Tygon surface cleans easily. If you find a scratch or break in the film caused by carelessness, touch it up with fresh Tygon Paint. The job will be as good as new.

Wherever you have wood, metal or concrete surfaces exposed to the corrosive fumes, gases or spillage — protect them with Tygon Plastic Paint coatings. You'll lengthen the time between recoatings 50% to 500%. And Tygon Paint costs no more than coatings that offer less than half the life.

Tygon plastic paint coatings are pure plastic in a solvent vehicle. Applied cold by spray gun or brush, they dry to form a tough plastic film, resistant to the attack of acids, alkalies, oils, alcohols or water.

•

Tygon Paint films bond tightly to metal, wood or concrete. They do not oxidize, show no chemical deterioration with age. Tygon Paint films are flexible and tough; resist impact without chipping or flaking.

•

Tygon Paint films are non-flammable when dry, possess excellent dielectric strength.

U. S. STONEWARE

Akron 9, Ohio

Tygorust primer and Tygon paint is a system that's hard to beat for chemical resistance, and long maintenance-free life.

Society News

New N. A. M. F. Officers

The new officers of the National Association of Metal Finishers, Inc., elected at Philadelphia are: President, Paul E. Miller, Miller Electroplating, Inc., Evansville, Ind.; First Vice-President, Wm. F. Walton, Walton & Lonsbury, Attleboro, Mass.; Second Vice-President, C. R. Wheeler, Elyria Plating Corporation, Elyria, Ohio; Third Vice-President, Albert W. Olson, Industrial Plating Works, Seattle, Wash.; Treasurer, Glenn Friedt, Jr., United Platers, Inc., Detroit, Mich.; Executive Secretary, Raymond M. Shock, 2117 LeRoy Place NW, Washington, D. C.

Hot Dip Galvanizers To Meet

Stuart J. Swensson, Secretary-Treasurer, announced that the 1953 Semi-Annual Meeting of the American Hot Dip Galvanizers Association, Inc., will be held at the Statler Hotel in Cleveland, Ohio on Monday and Tuesday, September 14 and 15.

The meeting will be highlighted by outstanding speakers from industry and the trade including a paper entitled "Selas Story in Galvanizing". A plant visitation is also contemplated in the Cleveland area. In addition, a color corrosion film will be shown.

International Conference

The International Conference on Electrodeposition and Metal Finishing, sponsored by the International Council for Electrodeposition, of which body the Institute of Metal Finishing (Great Britain) and the American Electroplaters' Society are prominent members, will take place in, or near, London, England in April, 1954. Plans are being made actively to this end by appropriate Committees appointed by the International Council

The Technical Sub-Committee of the Conference Committee now invites authors to submit manuscripts which will be considered by the Publications Committee of the Institute of Metal Finishing for presentation at the Conference.

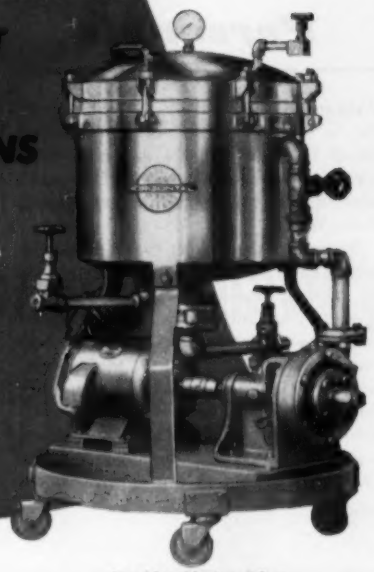
Papers should preferably deal with work of an original nature in the field of electrodeposition and metal finishing generally. Manuscripts should be forwarded to the Honorary Secretary of the Institute of Metal Finishing, Dr. S. Wernick, at 32 Great Ormond Street, London, W.C.1, England.

American Society for Testing Materials

Sixty-three new standards were approved at the 1953 ASTM annual meeting which was well attended by a near-record of 2472 persons. One hundred and ninety nine papers and reports were presented and 565 technical committee meetings were held.

FOR LOW COST FILTERING OF PLATING SOLUTIONS

SPARKLER HORIZONTAL PLATE FILTERS



Sparkler Plating Filter
Model 18-D-6 Alliron
600 G.P.H. Portable

HERE'S HOW

★ On a horizontal filter plate it is possible to apply a thin pre-coat with about one-third the filter aid, and in one-third the time required for pre-coating a non rigid media or a surface in a vertical position. This saves time and filter aid.

★ With the Sparkler horizontal plate you can apply this thin pre-coat evenly over the entire plate surface and start filtering immediately with less pressure and obtain maximum consistant clarity right from the start up to the end of the cycle.

★ A filter cake on a horizontal plate will not crack, slip or fall off even with varying pressure or a complete shut-down of the filter. No pre-coat renewal is ever required after an interruption in operation.

★ When it is necessary to clean the filter, the Sparkler filter tank can be emptied in a matter of minutes with a minimum of loss of valuable plating solution.

★ Any grade of filter paper from fine to coarse can be used in a Sparkler filter. This makes it ideal for carbon treatment of solutions. Carbon mixed with water in a stand-by tank is circulated through a clean set of filter paper on the plates until a carbon cake is formed. The solution requiring carbon treatment is then circulated through the carbon beds without contaminating the plating tank or a shutdown of plating operations.

★ At the end of the cycle with a Sparkler filter you can blow-down with air and produce a relatively dry cake that can be disposed of in a trash can rather than washing it down the drain with attendant sewer clogging problems.

★ You will find your Sparkler plating filter positive and dependable from a standpoint of uniform high quality filtering and economical in labor and material.

SPARKLER

Sparkler representatives in all principal cities are ready to give you personal service on your filtering problems, and show how you can make a material saving in operating cost.

MANUFACTURING COMPANY
Mundelein, Illinois

Sparkler International Ltd.
Prinsengracht 876, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill. U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 917.

Personals

William B. Beeson, Jr., of Pittsburgh, Pa., a veteran member of the Diamond Alkali Company sales organization, has been named sales manager of Diamond's new subsidiary, Belle Alkali Company, of Belle, W. Va.

Beeson's sales career with Diamond, dating back to 1933, was interrupted only by military service in World War II. Originally assigned to Diamond's Cincinnati (Ohio) Branch Sales Office, he was transferred in March, 1948, to the company's Pittsburgh Office, where shortly thereafter he was promoted to the position of assistant branch manager. He is a graduate of Washington and Jefferson College, Washington, Pa., where he was granted an A.B. degree in 1932.

Charles Murphy has been appointed by the Federated Metals Division of American Smelting and Refining Company as their representative of the Midwestern Plating and Electrochemicals Department. He will have headquarters in Whiting, Ind., and will serve the entire Midwestern Department in a sales and service capacity.

Murphy comes to Federated after 12 years' service with the Plating Products Company of Newark, N. J.

Robert E. Creamer has been named as district sales manager and **William E. Bridgett** as district sales representative for Connecticut by the Hanson-Van Winkle-Munning Company, Matawan, N. J. **W. M. Teets** has been appointed as representative for the New Jersey area and **Robert Morriss** as representative for the New York metropolitan area.

Creamer, whose headquarters will be at Stratford, moves up from his position as H-VW-M sales representative for Connecticut. He was former supervisor of plating at U. S. Naval Air Station, Quonset Point, R. I., from 1942 to 1945.

Creamer

Bridgett

Teets

Morriss

Before World War II, Creamer worked for H-VW-M for one year at its laboratories in Matawan. He left H-VW-M to go with Andrew B. Hendryx Company, New Haven, Conn. He spent six years with the Hendryx Company where he was supervisor of plating.

Bridgett leaves H. L. Judd Company, Wallingford, Conn., where he was superintendent of finishing. He spent 18 years with the Judd Company. Bridgett attended New Haven Junior College.

Mel Teets moves over to New Jersey from the metropolitan area where he has been a representative for H-VW-M for the past two years. Prior to that time, he spent a year in training at the company laboratory at Matawan. He is a graduate of Lafayette College, B.S. in Electrical Engineering, 1949.

Morriss moves down to New York from Stratford, Conn., where he was manager of the H-VW-M warehouse for four years. He formerly worked in the purchasing department as a buyer, and has been with the company for seven years.

W. O. Osborne has been appointed field representative for Allied Research Products, Inc., Baltimore, Md., and assigned to Cleveland to handle the northeastern Ohio–Western Pennsylvania territory, replacing the Baker Distributing Co. Osborne's headquarters are at Suite 403, 1501 Euclid Avenue, Cleveland 15.

Another new field representative for the company, **Earl H. Messmore**, has

A SOLUTION FOR EVERY CLEANING PROBLEM

The PERMAG line of cleaning compounds for the electrolytic cleaning process of the plating industry makes possible a solution for every cleaning problem.

With the skill and knowledge developed in over 30 years of service, PERMAG cleaning compounds are designed to provide maximum cleaning efficiency at the lowest possible cost to ease your daily operations and increase production.

PERMAG technical service is also available without obligation to assist you in any unusual or difficult cleaning question you may face. Why not take advantage of it today?

Write for your FREE Electroplaters Handy Pocket Size Manual on Cleaning Compounds.

MAGNUSON PRODUCTS CORPORATION
50 Court Street • Brooklyn 2, N. Y.
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UNICHROME
Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Costs reduced in hard chromium plating

The advantages of different "Stop-off" methods

In applying an insulating coating directly on the work, users of Unichrome Stop-off Lacquer get quick-drying, accurate application by brush or dip. Hot-dip Unichrome Wax Compounds hold a sharp line too, but can also be melted for reuse. Many plants prefer to wrap unwieldy work with Unichrome Tape for the extra convenience in applying and removing.

All these are single-time methods. Shielding offers a method good for an indefinite number of cycles for some work – especially when shields are made or insulated with plastisol Unichrome Coating 218X. This saves time, money, materials.

Chromium plating small parts no longer a problem

Economical plating of small parts has been made possible by the Unichrome 24-inch Chromium Plating Barrel. This development offers one of the most successful and efficient batch-type units ever built. Handling large quantities of work and producing a bright, high quality plate, it ends excessive racking costs once and for all.

Half a million small sewing machine parts, for example, were plated by one barrel, in one day, by one man. Another plant has installed 8 of these money-saving barrels and now does tremendous volumes of small parts plating in one shift.

Write for technical details.

Ucilon Coatings protect largest plating machine against corrosion

Plating departments, with their highly corrosive solutions and high humidity, make an ideal proving ground for protective coating systems. Ucilon Coating Systems have given 2, 3, and more years of service in many plating shops.

It was because of this durability under severe conditions that they were selected for protecting the largest wire plating machine at the plant of a famous concern. Walls, structural work and ductwork are also being "painted" with these coating systems.

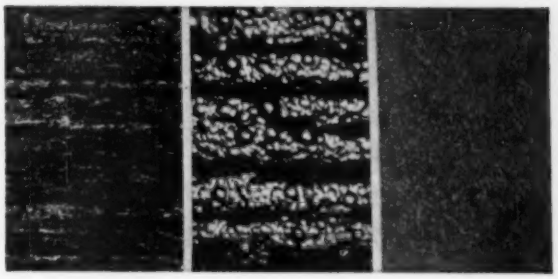
Details on the various types of Ucilon* Coatings are presented in Bulletin No. MC-7. Write for your copy. **Trade Mark*

UNITED CHROMIUM, INCORPORATED
100 East 42nd St., New York 17, N. Y.
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada:
United Chromium Limited, Toronto, Ont.

New economies found through unusual chromium deposits produced by Unichrome SRHS Bath

A New England manufacturer, plating dies and plugs in the Unichrome SRHS Chromium Bath instead of the ordinary bath, found that tool life was being substantially increased. At the same time, plating time had been cut in half.

This case highlights the essential improvement that has been made since the advent of SRHS Chromium Solutions – that it is now possible to plate at *higher* speed and still get far *smoother* deposits than heretofore.



Untreated steel | *Plated in ordinary bath* | *Plated in SRHS Bath*

These advantages are well known in the field of decorative plating. But the unusual nature of the deposits and the speed become all the more striking when "hard" or relatively thick plating is done.

PHOTOMICROGRAPHIC EVIDENCE

The photomicrographs above show the reason why the Unichrome SRHS Solution produces a smooth plate. With unusual "leveling action," this bath smoothed over the minor surface irregularities – while producing a 40% thicker plate than the ordinary chromium bath, in the same time, and under the same conditions.

Such a deposit saves grinding and polishing. This saving cuts required deposit-thickness which still further reduces plating time.

ANOTHER REASON FOR SPEED

Unichrome SRHS Chromium Baths have wider bright plate range. As a result, full advantage can be taken of higher operating curent density for fast deposition of metal without burning on projections. Deposits also show little or no evidence of "treeing," even at high speeds.

MINIMUM EFFECT ON STEEL

Chromium plating increases steel's resistance to corrosion and wear. But it is known also to reduce its fatigue limit. Research shows, however, that high strength steel plated in SRHS Chromium suffers the smallest loss of fatigue strength. This is clearly shown by these tabulated results from an independent university laboratory on heat-treated test specimens plated with .001" of chromium.

Chromium Plating Solution	*Fatigue Strength psi*	*% Loss Over Unplated*
Unplated	81,500	–
Ordinary	60,500	25.7
SRHS CR-100	75,200	7.7
SRHS CR-110	75,300	7.6

Hard chromium plating in the SRHS Bath, therefore, can enable designers to specify lighter parts or smaller cross sections while maintaining the usual safety factors. Platers are finding more and more of their industrial customers *specifying* SRHS Chromium Plating for this reason.

• • • •

While it's still chromium, you can see there's a distinct difference when it's deposited from a Unichrome SRHS Chromium Bath. In addition, the bath offers operating advantages: It can regulate itself, minimize control problems, and maintain peak plating balance. With higher cathode efficiency, it also cuts power requirements and increases capacity without extra equipment.

Write or phone for more data. Or better still, ask a United Chromium finishing engineer to give you all the facts.

"GENTLEMEN, WE MUST CONSIDER OVERALL COST, TOO!

"THESE FACTS AND FIGURES PROVE THAT THE NEW CHANDEYSSON MOTOR-GENERATOR, FOR PLATING OR ANODIZING, COSTS LESS THAN OTHER POWER CONVERSION METHODS" - -

Higher Efficiency—
CONSUMES LESS POWER

The NEW 5,000 amp. 12 volt Chandeysson Motor-Generator, with an *overall* power efficiency of 85% plus, may save upwards from $800.00 a year in power consumption alone, or $9,600.00 in the *first twelve years of its operation**, when compared to units of similar rating used in other power conversion methods. In *overall* cost, the Chandeysson Generator is less . . . in *overall* power efficiency, the Chandeysson Generator is greater!

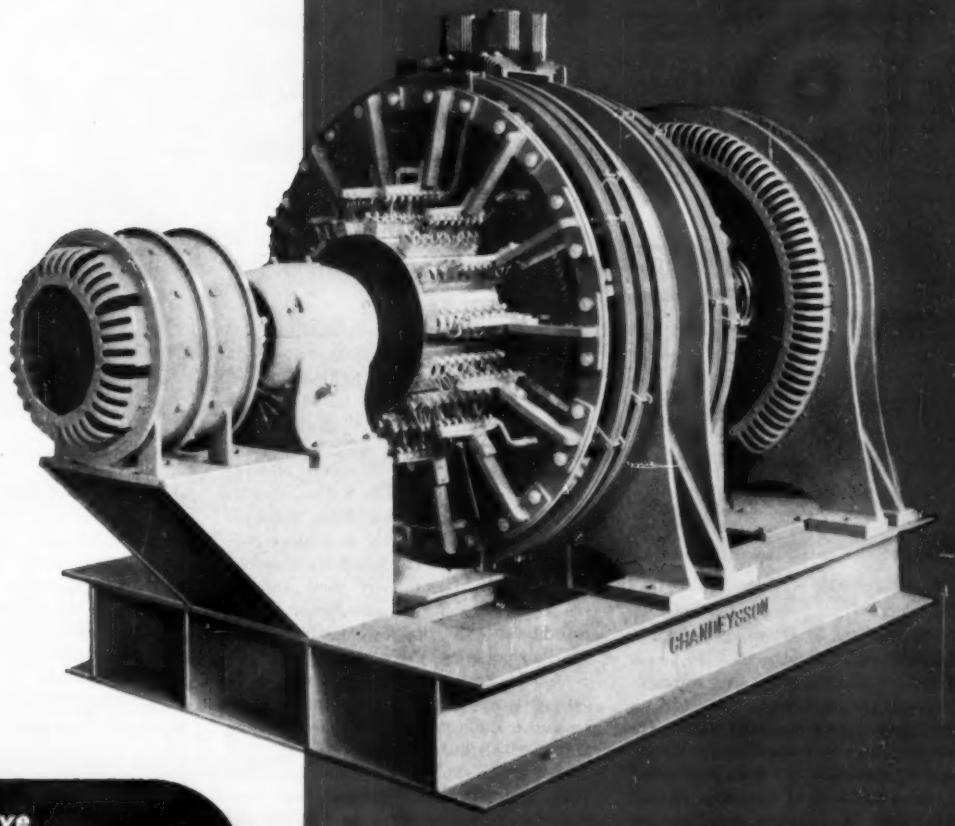
**Based on power rate of 1¢ per kilowatt hour.*

Better Power Factor—
HIGHER PLANT EFFICIENCY

The Chandeysson Synchronous Motor, with a built-in 80% leading or unity power factor, assures you of a remarkably high degree of efficiency. By improving the overall plant power factor from 80% lagging to 90% lagging through installation of a synchronous motor, the NEW Chandeysson Generator will reduce the shop current as much as 11% for the same kilowatt load all along the line! You'll save on power bills and reduce transformer and feeder losses throughout the entire plant!

Tailored Design & Construction—
A LIFE-TIME OF SERVICE

The Chandeysson Motor-Generator, especially designed for the Electrolytic Industry, operates at *peak* efficiency for years and years even under the most adverse conditions. There are Chandeysson Units still in constant use after forty-eight years of service! The Chandeysson Generator will pay for itself over and over again and, regardless of its age, always has a high resale value.



Higher Reserve Capacity — WITHSTANDS GREATER OVERLOADS

Chandeysson Motor - Generators have been known to carry loads far in excess of rated capacity for long periods without damage to the unit. They can be counted on to deliver a steady flow of current through intermittent high overloads without the risk of harming the unit or spoiling the work in the tank. Like the Chandeysson name, the Chandeysson Motor - Generator is something you can depend upon!

IT WILL PAY YOU TO INVESTIGATE THE STORY OF THE NEW CHANDEYSSON MOTOR-GENERATOR — WRITE FOR BULLETIN D101; NO OBLIGATION OF COURSE.

Chandeysson ELECTRIC COMPANY
1078 Bingham Avenue
St. Louis 16, Missouri

324

Personals

been assigned to Indianapolis and will handle the northern Indiana and northwest Ohio territory. Messmore's headquarters are at 200 Standard Building, Fort Wayne, Ind.

Dr. John Barry Davidson has been named as the new Director of Research of the Cowles Chemical Company, Cleveland, Ohio and will be directly in charge of the research laboratories in Syracuse. Dr. Davidson took his undergraduate work at Williams College and his graduate work at Massachusetts Institute of Technology, where he received his Doctor's degree. He was a group leader on research projects for Sharples Chemicals, Inc., for a number of years and later was

Davidson **Parisho**

Associate Director of Research for Plaskon Division of Libbey-Owens-Ford Glass Company. A number of patents and patent applications on surface active agent,s silicones and paper-treating resins are assiciated with Dr. Davidson's name. **George E. Parisho** has been appointed to the sales territory of Southern Illinois and St. Louis, Mo., for the metal cleaner department of the company.

Parisho is well qualified to give valuable assistance to industrial metal working companies having had extensive experience in metal working and finishing industries.

Robert H. Hoff has been appointed to the sales staff of the Metal Finishing Division, Frederic B. Stevens, Inc., Detroit. Hoff, a Chemical Engineer, was employed as a Sales Engineer by Grow Solvent Company, Detroit, before joining the Stevens organization. He will cover the territory of southern Michigan.

He attended the Illinois Institute of Technology and graduated from University of Detroit and is a membe· of the Detroit Chapter, American Chemical Society and the American Electroplaters' Society.

Harold W. Faint has been appointed Chicago District Sales Manager for the Metal Finishing Division. Immediately prior to joining Stevens, Faint was Sales Manager, Industrial Filter & Pump Manufacturing Company, Chicago, where he was employed seven years. He also has 20 additional years' experience in allied industries, all related to the field of metal finishing. Faint is a member of several

Hoff **Faint**

professional and fraternal organizations and is, at present, serving on the Board of Managers, Chicago Branch, American Electroplaters' Society.

Announced at the same time was the addition of **Robert R. Seaman, Donald E. Lind** and **Howard Michaels** to the fast growing staff of the new Customer Service Department of the company at Detroit.

R. R. Seaman is a graduate of University of Michigan and also holds a degree in Electrical Engineering from the University of Detroit. Prior to joining Stevens, Seaman was employed by Hanson-Van Winkle-Munning in their Detroit District Office. He is a member of American Institute of Electrical Engineers and Engineering Society of Detroit.

Donald Lind joins Stevens with considerable experience as a Customer Service and Installation Engineer, having been employed in that capacity for eight years with the Cross Machine Company, Detroit, and Standard Cap and Seal Corporation, Chicago. Prior to that he was employed in the Production Engineering Department of Bastian-Blessing Company, Chicago.

Lind received his education at Northwestern University, Evanston, Ill., and also completed the Tool and Die Apprenticeship requirements at Lake Shore Engineering Works, Marquette, Mich.

Howard Michaels has been with the Stevens organization for some time, on service work. He was employed in the General Maintenance Department at Packard Motor Car Company, Detroit, before coming with Stevens. He is a member of the Detroit Branch American Electroplaters' Society and the Engineering Society of Detroit.

Kenneth L. Bullock has been appointed Assistant Sales Manager of The Process Equipment Division of the U. S. Stoneware Company, Akron, Ohio, with headquarters in the Akron office.

Bullock holds the degree of Bachelor of Science in Organic Chemistry from the University of Delaware, and is a member of the American Chemical Society.

Seymour J. Fiebach has been named Sales Engineer in the metropolitan New York area for the Carboline Company of St. Louis, Mo. Fiebach has sold industrial chemicals in the area since 1948 and was previously an instructor of Chemistry at Brooklyn College in New York City.

James Bennett, graduate of General Motors Technical Institute and former Process Engineer for the Buick Motor Car Company, has been appointed as Plant Manager of Naraco's new consolidated Imperial Plating Rack Company of 1109 E. Stewart Ave., Flint, Mich.

Bennett **Smith**

Alvin Smith has been appointed as Sales Manager of the company. Smith was formerly with the Buick Motor Car Company for twelve years and has had extensive experience in handling problems connected with designing and manufacturing plating racks and fixtures and materials handling equipment for the automobile trade.

Howard S. Griffin of Toronto has been appointed Canadian sales representative for American Nickeloid Company, Peru, Ill. Operating out of the company's Canadian office at 82 Richmond Street, Toronto, Mr. Griffin will be in charge of Nickeloid pre-plated metal sales for the provinces of Ontario and Quebec.

Well known in Canadian and foreign trade circles, the new representative has been actively engaged in export and import work for many years. He is a graduate of Queens University in chemical and metallurgical engineering and is also associated with G. R. Marshall & Co., Ltd. of Toronto in the operation of their import department.

Obituaries

✣ **Gail E. Barr,** Superintendent of the Natrona, Pa., plant of the Pennsylvania Salt Manufacturing Company, died June 6 after a brief illness at his home in nearby Freeport. He was 56 years old.

Mr. Barr, who joined Pennsalt in 1912, first worked in the Natrona plant laboratory. He served in the A. E. F. in World War I and after returning to the Company, became a Process Supervisor.

He became Production Supervisor in 1943 and was promoted to Superinten-

FOR PRECISION STOPS . . .

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. . . is designed to achieve an accurate line of demarcation in all plating cycles. It will go through cleaners and hot solutions without losing its exceptional adhesion, unsurpassed on sharp edges. The finest all purpose stop-off lacquer on the market today.

MICCROMASK

. . . is specifically designed for maximum adhesion in hard chrome plating. It will hold to a fine line and may be easily removed after plating. Dries rapidly. Multiple coats will take any long cycle without treeing.

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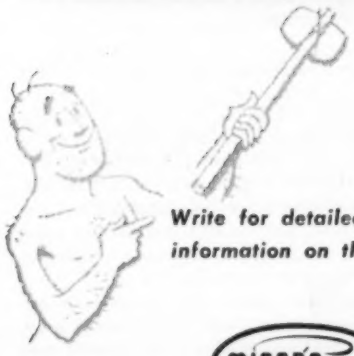
. . . C-562 is the outstanding product for the most efficient method of selective hard chrome plating. Melting at 180°F, it is especially applicable for flat surfaces and sharp edges, where dipping is feasible.

. . . C-600 will take all plating cycles without losing adhesion. Melting at 300°F, it is not affected by temperatures, acids, or caustics used in any plating operation.

Both MICCROWAX C-562 and C-600 may be reused. Only one dip tank is required. Both harden immediately, cutting down application time to a minimum.



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high corrosion resistance
paint base
bright finishes
final finishes
SPECS FOR NON-FERROUS FINISHING GOT YOU DOWN?
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IRIDITE
TODAY for
finishing ZINC, CADMIUM, ALUMINUM, CUPROUS METALS
WANT CORROSION RESISTANCE? Iridite will give you better-than-specification protection against corrosion.
WANT PAINT ADHERENCE? Iridite provides a firm and lasting base for paint by preventing under-film corrosion.
WANT EYE-APPEAL? Iridite can give you a variety of finishes, depending upon the metal being finished . . . from clear and sparkling bright or military olive drab, to attractive dyed colors.
BEST OF ALL, any Iridite finish is economical and easy to apply.
for example: IRIDITE (AL-COAT)
REDUCES NEED FOR ANODIZING
Simple chemical dip; immersion time only 10 seconds to 2 minutes; no sealing dip; color is clear or yellow depending upon your requirements; salt spray resistance equivalent to 20 to 30 minutes of anodizing, eliminates need for costly racks and electrical power.
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4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.
Manufacturers of Iridite Finishes
for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Brightener.

Personals

dent in 1948. During his tenure as Superintendent a number of new products and processes were introduced at the Natrona plant. Mr. Barr was also Superintendent of the Natrona Light & Power Co. and the Natrona Water Co., Pennsalt public utility subsidiaries.

✣ **Dr. Pierre I. Chandeysson** died in a St. Louis hospital on June 5, 1953, following a coronary thrombosis.

Chandeysson

Born in France, Dr. Chandeysson came to America at the age of seventeen. Eight years later, in 1901, he graduated from Washington University, College of Medicine, and joined the staff of the St. Louis City Hospital, specializing in pediatrics. While studying at the University and in the years that followed, Dr. Chandeysson pioneered the design and development of low voltage, high current generators for electroplating use. He formed the Chandeysson Electric Company, gave up his medical practice and set about to the challenge of electrifying American Industry, making significant developments in telegraphy, ticker mechanisms, railroad signals, medical magnets and homopolar generators.

As industry expanded, the demand for electroplating generators reached the point where the entire production of Chandeysson Electric was channeled into this activity.

In anticipation of his retirement, Dr. Chandeysson transferred his ownership of Chandeysson Electric Company to a family trust 12 years ago, under which it has since operated.

✣ **Dr. Nathaniel Thon**, Project Director of A. E. S. Research Project No. 6, died June 22 in the Princeton, N. J., hospital. Born in Krakow, Poland, he obtained his doctor's degree at the University of Berlin. He was a research project director in Paris for the International Tin Research and Development Council prior to his appointment as a research associate at Princeton University.

Dr. Thon also served as editor for the Committee on Tables and Constants for the National Academy of Sciences and also as a special staff member of Chemical Abstracts.

treat TOXIC CHROMIUM WASTES *by* REDUCTION

Chromium wastes, because of their toxicity and high color, are a problem for industry and an annoying source of stream polution.

Reduction of toxic hexavalent chromium wastes to the trivalent form with sulphur dioxide, and subsequent precipitation with alkali, has become widely accepted in the plating industry. Wallace & Tiernan offers not only the equipment for feeding sulphur dioxide but also the experience of many installations to successfully carry out the reduction process.

CYANIDE WASTES

Wallace & Tiernan's service to the metal finishing industry also includes experience and equipment for effective destruction of cyanide wastes by alkaline chlorination. Automatic control equipment assures complete cyanide destruction with minimum chemical costs.

Write today for additional information on Wallace & Tiernan equipment for the reduction of toxic chromium wastes with sulphur dioxide and the oxidation of cyanide wastes by alkaline chlorination.

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Trade Literature

L—800. New Finishing Bulletin—Pelron Corporation, 7652 W. 47th St., Lyons, Ill., announces the publication of a new brochure dealing with Pelron's services and products for the finishing industry. The services described in detail include special problem studies and recommendations regarding metal cleaning, phosphating, paint stripping, and paint booth operations.

Also included in the bulletin are detailed descriptions of their line of standard products which have been specially developed to handle various specific metal finishing jobs. For your copy of the new bulletin use Reader Service Card.

L—801. Flexible, Liquid-Tight Conduit—First of its kind to gain Underwriters' Laboratories approval for use in wet locations, "Sealtite" flexible liquid-tight electrical wiring conduit is described in a 4-page illustrated publication. Suggested applications, specifications are included. Made with flexible galvanized steel core, positive ground and tough synthetic cover, "Sealtite" protects wiring against moisture, dirt, chemicals, and corrosive fumes. Copies of Bulletin UA-530-P mailed on request. Address: The American Brass Company, American Metal Hose Branch, 692 Main St., Waterbury, Conn., or use Reader Service Card.

L—802. New Brochure On Adhesives and Coatings—A new 12-page, two-color, 8 x 10, illustrated brochure describing the many applications of adhesives, sealers, and coatings as used by the automotive manufacturing industry, is now available from Minnesota Mining & Manufacturing Co., Adhesives & Coatings Division, 423 Piquette Ave., Detroit 2, Mich. Included in the brochure (Bulletin Z-AMM) are specific recommendations for each type of application.

Twenty-three of these automotive applications for adhesives, sealers, and coatings are pictorially illustrated.

Coatings, including strippable types also used extensively in the aircraft industry, are covered in section III. These as well as underbody and chrome coatings are also well illustrated. For your copy of this brochure use Reader Service Card.

L—803. New Shelving & Locker Catalog—Precision Equipment Co., 3712 N. Milwaukee Ave., Chicago 41, Ill., has just published a new catalog featuring steel shelving, lockers as well as other storage and maintenance equipment for industrial use. The new catalog also contains the popular column entitled, "Heard in the Locker Room" which adds additional sparkle to Precision catalogs. For your copy use Reader Service Card.

L—804. Demineralizer Catalog Sheet—A new catalog sheet which describes Penfield's new M-100 mono-column demineralizer has been issued by the Penfield Manufacturing Company, Inc., 19 High School Ave., Meriden, Conn. A photograph and schematic diagram on the front of the sheet, combined with the detailed description of parts, sample specifications and performance data on the reverse side, provide a quick, concise and complete resume of all essential information. The new M-100 demineralizer operates on the extremely efficient and economical mono-column method: cation and exceptionally strong anion exchangers intimately mixed in a single unit tank through which the raw water is passed only once. For your copy of this informative literature use Reader Service Card.

L—805. Properties of Electrodeposited Nickel and What Influences Them. Bulletin A-153—An extended illustrated abstract of 5 pages by the International Nickel Company, Inc., of a report of a 5-year investigation sponsored by the American Electroplaters' Society and carried out at the National Bureau of Standards. Discusses, in a general way, uses; baths and types of deposits; and, specifically, properties of deposits and the variables that influence them; composition and structure of deposits. The results of this study are of interest to users and producers of nickel plating for (a) electroformed shapes, (b) building up worn or over machined components and (c) heavy industrial coatings that impart nickel's corrosion resistance to common materials of construction. For your copy use Reader Service Card.

L—806. New Nickel-Lined Pipe Booklet—"Positive Corrosion Control" is the title of the new 8-page booklet published by Bart Manufacturing Corporation of Belleville, N. J. Illustrated with many typical samples of nickel-lined pipe, fittings and flanges, the booklet discusses the exclusive Bart Lectro-Clad process and uses for nickel-lined steel pipe for corrosion protection. Included in the material are test results gathered over a period of 10 years in various installations, as well as descriptions of applications in the petroleum fields, organic and inorganic chemical industries, pulp and paper production and the handling of corrosive materials generally. For your copy use Reader Service Card.

L—807. Liquid Processing Equipment Catalog—The Alsop Engineering Corporation, 800 Fine St., Milldale, Conn., offers a new 32-page catalog written especially for the plant personnel. It contains photos, diagrams and comprehensive information on the entire Alsop line of stainless steel liquid processing equipment, including filters, mixing and storage tanks, portable mixers, fixed-side and top-entering agitators and transfer pumps.

The catalog treats each product separately; their features are described clearly and completely with an explanatory text, numerous plant installation illustrations, design variations, detail drawings and parts lists, application and performance data.

The catalog also makes known the services of the Alsop Engineering Staff to design special units which might be required to fit the customer's specific job. For your copy of the catalog use Reader Service Card.

L—808. Flaw Location Booklet—This booklet issued by Turco Products, Inc., Terminal Annex 2649, Los Angeles 54, Calif., outlines the many applications of Turco Dy-Chek, the completely portable inspection method, and Turco Chek-Spek, its high-speed partner for use on the production line. It describes how surface-active chemistry gives simple, economical methods for discovering dangerous, hidden flaws. For your copy use Reader Service Card.

L—809. New Pennsalt Chart Shows Corrosion Resistance of Cements to 297 Chemicals—How do you know which kind of corrosion resistant cement to use to handle the particular chemicals you use in your processes?

To provide a ready answer to this complex question, the Corrosion Engineering Department of the Pennsylvania Salt Manufacturing Company has prepared a comprehensive chart showing the resistance of seven classes of corrosion resistant cements to 297 of the most generally used corrosive chemicals.

The chart indicates that Pennsalt has a cement mortar which is resistant to the chemical attack of every one of these chemicals except sodium hypochlorite which, being an oxidizing agent on the alkaline side, will attack most materials at certain temperatures.

Copies of the new chart may be obtained by writing to the Corrosion Engineering Department, Pennsalt Chemicals, 1000 Widener Building, Philadelphia 7, Pa., or by use of Reader Service Card.

L—810. New Buffing Compound Bulletin—As an addition to their series of six bulletins issued last year, Apothecaries Hall Co. of Waterbury, Conn., has just issued Bulletin B-7 entitled, *AHCO* Buffing Compounds. The bulletin contains information about their complete line of

Trade Literature

grease bars, including among other types tripoli and white compounds. Copies of the new bulletin are available on request. Use Reader Service Card.

L—811. Corrosion Proof Linings Booklet—A new 8-page folder describing Nukem tank rubber and brick lining services has been announced by Nukem Products Corporation, Buffalo 20, N. Y. Included in the folder are two pages listing over 90 different corrosive solutions. In these pages the relative resistance of Nuran rubber, Koroseal, Neoprene, soft or semi-hard rubber and Nu-Mastic linings are given for the various corrosive solutions. For your copy use Reader Service Card.

L—812. Notes on the Preparation of Aluminum for Welding—Northwest Chemical Company of 9310 Roselawn, Detroit, manufacturers of specialized chemical cleaners, announce a new 12-page brochure completely describing their Alkalume Process.

Alkalume is the revolutionary process for preparing aluminum, magnesium, and hard-to-clean steels for welding, and other finishing operations.

It cleans without harming the metal, dissolves and removes the surface oxides, reduces the surface resistance to a value of 0 to 10 microhms, and preserves for long periods of time a surface resistance between 10 to 20 microhms. For your copy of this informative brochure use Reader Service Card.

L—813. New Metal Hose Catalog—Titeflex helically wound flexible metal hose and Uniflex helically corrugated flexible metal hose are illustrated and described in a 50-page catalog just published by Titeflex, Inc., Newark, N. J.

Featured in the Engineering Data section are charts showing frictional losses versus flow rates for various sizes of metal hose and conduit. These flow charts are believed to be the first ever offered in a metal hose catalog and can be used as a standard for flexible metal hose of various types. The Engineering Data section also contains complete information on installation and maintenance of metal hose. Another "first" is a completely illustrated story showing how seamed metal hose is manufactured, from metal strip to completed assembly. For your copy of the catalog use Reader Service Card.

L—814. New Bulletin on Metallic Rectifiers—A new two-color booklet describing General Electric's complete line of manually controlled and automatically regulated metallic rectifier power supplies for electroplating and similar processes, has been announced as available from the Company at Schenectady 5, N. Y.

The fully illustrated 16-page publication, GEC-970, describes the advantages, applications, and operation of the units and lists ratings, dimensions, and specifications. For your copy use Reader Service Card.

L—815. Non-Plasticized PVC Data Sheets—H. N. Hartwell & Son, Inc. of Boston, Mass., have issued new data sheets describing properties and uses and basic information about Boltaron 6200. The material is a rigid, unplasticized polyvinyl chloride. It is extremely versatile, has a wide range of applications, and is outstandingly resistant to corrosion caused by organic and inorganic acids, alkalies, alcohol and foodstuffs. For your copy of these data sheets use Reader Service Card.

L—816. New Pump Folder—A full line of acid pumps is shown in a new folder, covering pumps operated by air line pressure, hand or foot, for withdrawing liquids from carboys, drums or barrels.

For your copy write to the General Scientific Equipment Co., 2700 W. Huntingdon St., Philadelphia 32, Pa., or use Reader Service Card.

L—817. Safety Solvents Fact Sheets—A 3-page booklet on three tailored types of Klearall Safety Solvents has just been published by Octagon Process Inc., of 15 Bank St., Staten Island 1, N. Y. All have been expressly developed for cleaning electrical and mechanical equipment where fire and explosive hazards are present and toxic odors are objectionable. The booklet gives instructions for use and specifications. For your copy use Reader Service Card.

L—818. Bulletin on New Rosin Core Solder—Federated Metals Division, American Smelting and Refining Company has published a 4-page bulletin describing a new rosin core solder. Known as RTS 200, it is available in a wide variety of wire sizes, compositions and quantities.

The bulletin describes five ways in which the new rosin core solder is superior to ordinary rosin core solders. First, it has 20 per cent greater spread; second, it has 4 times faster oxide penetration; third, it is non-corrosive; fourth, it is non-toxic, and fifth, it has a stable flux. For your copy use Reader Service Card.

L—819. Industrial Soldering Irons Bulletin—Soldering irons and soldering iron tips for industrial applications are described in a new bulletin announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as GEA-4519, the 8-page, 2-color publication uses photographs, diagrams, and tables to describe soldering iron construction, application, ratings, and prices. Also included is a full page chart which describes the purpose of flux and which flux is best suited to the base material or applied finish. For your copy use Reader Service Card.

L—820. Automatic Steam Cleaner—Automatic firing is the major development in a newly designed high volume steam cleaner now being manufactured by Kelite Products, Inc., 1250 N. Main St., Los Angeles 12. A free illustrated brochure gives full information and specifications on the device. For your copy of this descriptive brochure use Reader Service Card.

L—821. High Pressure Boiler Feedwater Demineralization—Mixed bed and two-step demineralization are two processes utilizing the unique properties of cation and anion exchange resins to effectively reduce dissolved silica and solids in water in order to meet exacting specifications of high pressure boiler feedwater. Commercial development of high capacity ion exchange demineralization apparatus now offers the possibility of producing economically, water both low in electrolyte content and dissolved silica. In fact, the dissolved silica can be reduced to levels approaching 0.01 ppm.

These are the conclusions reached in a 16-page reprint of a paper, "Mixed Bed vs. Two-Step Demineralization of High Pressure Boiler Feedwater", by M. E. Gilwood and Dr. C. Calmon of The Permutit Company, New York 36, N. Y. For your copy use Reader Service Card.

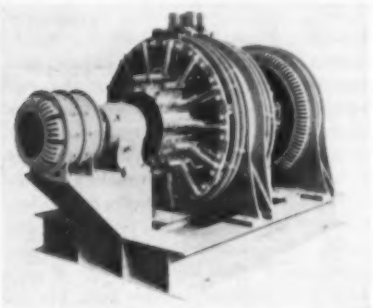
L—822. Bulletin on Descaling Steel Sheets—Descaling hot-rolled steel sheets by airless blasting and eliminating acid disposal problems are the topics discussed in a new bulletin published by American Wheelabrator & Equipment Corporation, 1180 S. Byrkit St., Mishawaka, Ind. Giving an actual case history with performance data, and illustrated by photographs of the equipment employed, plus a flow diagram of a sheet descaling line, this bulletin shows how important savings were made available to one company by airless blasting, because it was able to conveniently employ hot-rolled steel in place of cold-rolled. Copies of the brochure can be obtained. Use Reader Service Card.

L—823. Gold Plating Data Sheet—Announced as available is a technical data sheet on electroplated gold which is important because, for the first time, it shows the way to scientific control of the process and because it also offers the scientist the most complete compilation of information on gold ever assembled; also some data not heretofore available.

Readers can obtain copies by writing to Technic, Inc., 39P Snow St., Providence, or by using Reader Service Card.

Equipment and Supplies

E—824. Chandeysson Redesigns Line of Motor Generators—Chandeysson Electric Company, St. Louis, Mo., have made a redesign of its line of low voltage motor-generator equipment, featuring improved commutation, all-welded steel



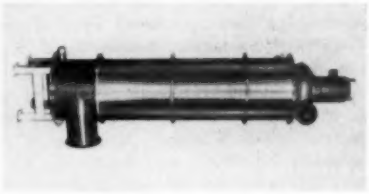
construction, increased accessibility and more open ventilation, which results in greater overload capacity and higher overall efficiency.

Generator and exciter brushes, coils and commutator are now fully accessible for inspection, cleaning or removal, without the necessity of removing any other components. Higher overall efficiency is realized with the new design which allows unrestricted air circulation around and through the generator. The exciter brushes are mounted on the inboard side to prevent accidental damage and also to insure smoother operation, thereby increasing brush life. For additional data on the redesigned generators use Reader Service Card.

E—825. Rustproofing Agent for Steel—Enthone, Inc., has announced a new product designated as Enthone Compound NR-31 to prevent rusting of steel, cast iron and other iron alloys during storage. The product is a mildly alkaline, water-soluble material used in a concentration of 1 oz/gal. It leaves almost no visible film on the steel. Tests have indicated that it will protect iron and steel against rusting in 100 per cent humidity for several weeks or more. The product is readily removed by washing with water. It contains surface active materials to facilitate rapid drying of water and to provide for uniform distribution of the anti-rust compound over the surface of the object.

Technical bulletin and free sample may be obtained by writing to Enthone, Inc., 442P Elm St., New Haven 11, Conn., or through use of Reader Service Card.

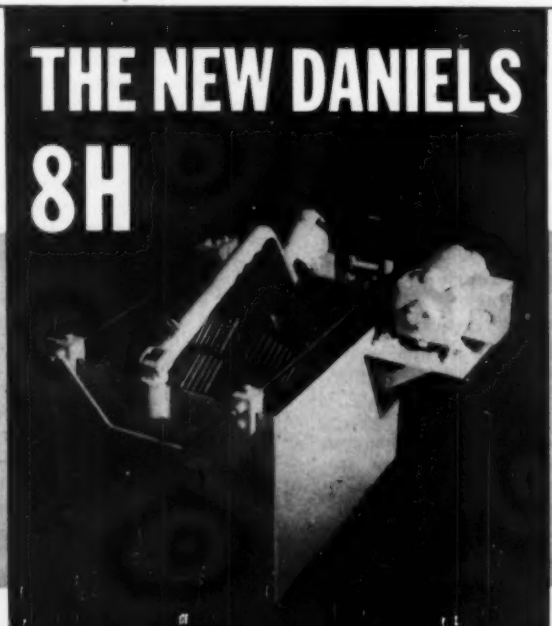
E—826. Fume Washer—The U. S. Stoneware Company, Akron, Ohio, has announced the development of a compact, portable, yet high performance fume washing tower for general laboratory and industrial use.



The fume washer consists of a metal stand on which the tower is supported; a bottom section containing a packing support plate, liquor-drain pipe and fume intake duct; one, two, or more packed intermediate sections; a distributor section with water inlet; and a top section containing the exhaust fan, drive motor, and washed air exhaust duct.

The new fume washer is outstanding for its light weight and use flexibility, made possible through simplicity of construction. Of particular importance to users is the long life and low maintenance expectancy of the unit. The unit is easily

THE NEW DANIELS 8H



Daniels presents the radically new 8H Plating Barrel with these innovations:

- New Cylinder Arm and Arm-lock
- New Materials and Modern Design
- New rubber-covered Contact Frame
- Three Cylinders to choose from — Bakelite, Rubber or high-temperature Lucite

Designed to fill the demand for a small barrel for efficient plating of small lots of bulk parts, the 8H is ideally suited for precious metal plating, laboratory work and as a supplement to the production plating plant.

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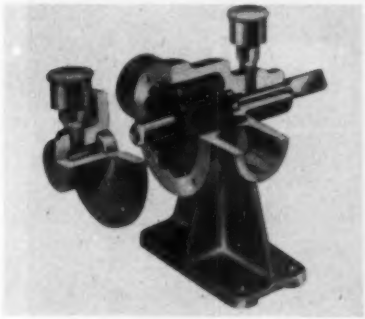
and quickly dismantled, moved to a new location and reassembled. For more information on this equipment use Reader Service Card.

E—827. Improved Pump Impeller Design—Use of an entirely new impeller design that improves priming qualities and increases pump output with the same power is an outstanding feature of the new Hypro general purpose pump, manu-



factured by Hypro Engineering, Inc., 404 N. Washington Ave., Minneapolis 1, Minn. The new impeller, moulded in a tough, durable rubber, has 12 vanes (twice the conventional number) which result in greater displacement and greatly improved pump priming. Sharp lateral wiping edges on each vane minimize friction by reducing impeller drag, produce less unit wear and improve mechanical efficiency of the pump up to 15 per cent. Another advantage of the multi-vane impeller is the even, continuous flow of liquid realized with the design. For more data use Reader Service Card.

E—828. New Electroplating Rack Coating—Hanson-Van Winkle-Munning Company, Matawan, N. J., announces a superior new coating for insulating and protecting racks, fixtures and anode hooks used in electroplating baths. Kote-Rax Grade L, a plastisol coating, is specially formulated to reduce maintenance cost.

Because it is unusually tough and ductile, the Grade L coating will withstand rough treatment and abuse, and will wear longer both in and out of the plating bath. The new coating is resistant to all of the commonly used cleaning, pickling and plating solutions.

An electroplater can easily apply Kote-Rax Grade L to his racks and fixtures. Because the coating is solvent-free, no ventilating system is needed to carry away fumes.

For other information, write to John P. Carton, H-VW-M, Matawan, N. J., or use Reader Service Card.

E—829. Quick Pik Dry Acid Pickle—The Mitchell-Bradford Chemical Company, 2446 Main St., Stratford, Conn., announces a new product Quick-Pik, a

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with lasting reliability

The engineering and construction features of INDUSTRIAL filters add up to maximum clear filtrate with less floor space, greater operating conveniences, and less maintenance delays and expense. The general design permits the use of the materials best suited to the solution requirements. Vertical filter leaves with ample flow space on both sides offer maximum filtration area. Outside lockup simplifies the installation of filter leaf and bag assemblies. An exclusive air-wash cleaning method practically eliminates the usual labor and inconvenience of dismantling the filter after every cycle. INDUSTRIAL filters are often in operation for months without removing the cover — cutting downtime to a minimum. All these features have been proved in long-life service — your assurance of dependable bonus performance.

Full particulars and recommendations on any filtration job will be given upon request.

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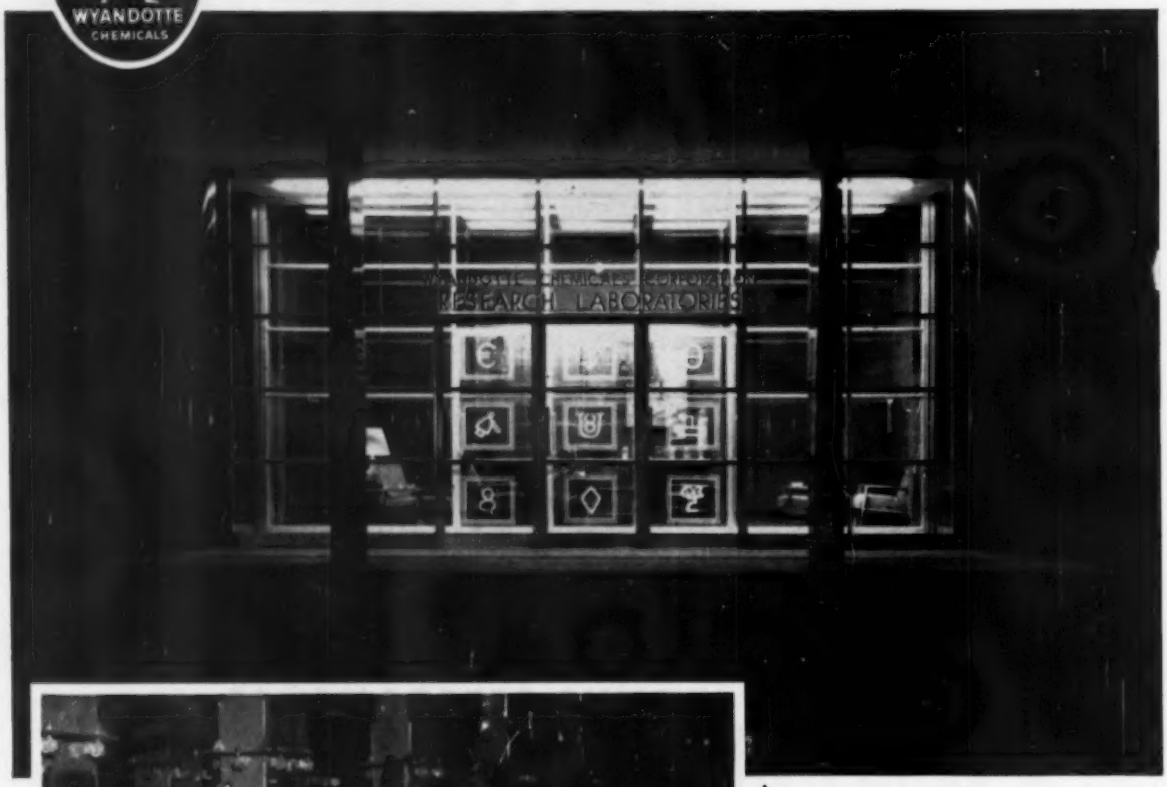
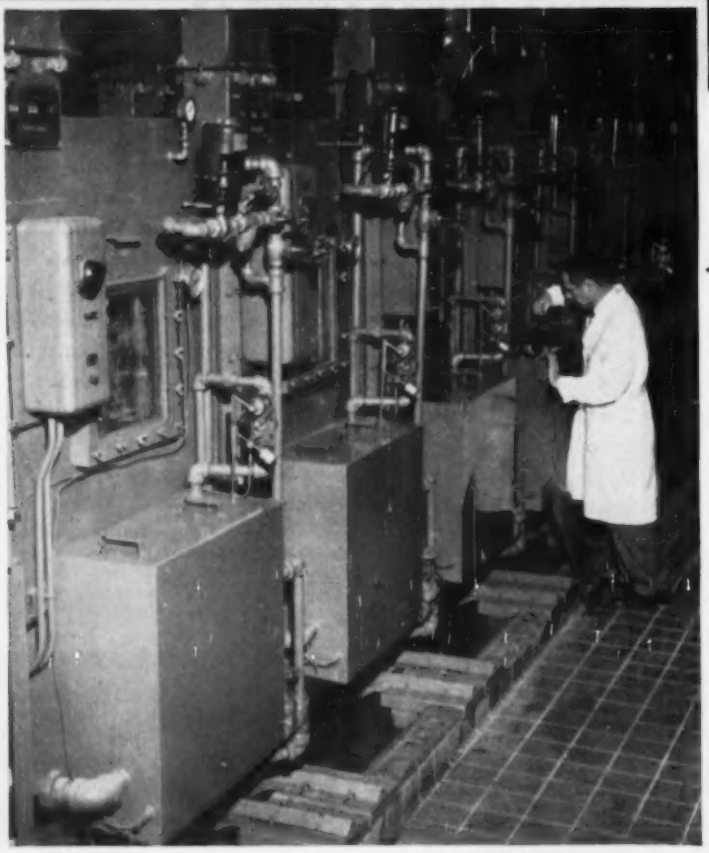
Gateway to "lower cost" with



Entrance to Wyandotte's new research building portrays symbols the alchemists used. Inside, the newest and finest facilities are employed to develop the best compounded chemical products available.



Unique, custom-built industrial spray washer consists of six removable and interchangeable stages, plus a hot-air blow-off unit. The six stages can be operated independently, moved in or out, and have complete controls for variable pressures and temperatures. Any kind of spray-washing cycle can be duplicated. This equipment can handle acids, alkalies, and emulsions. It is typical of the modern facilities and methods used throughout Wyandotte's industrial research department — one of the many reasons why it will pay you to deal with Wyandotte.

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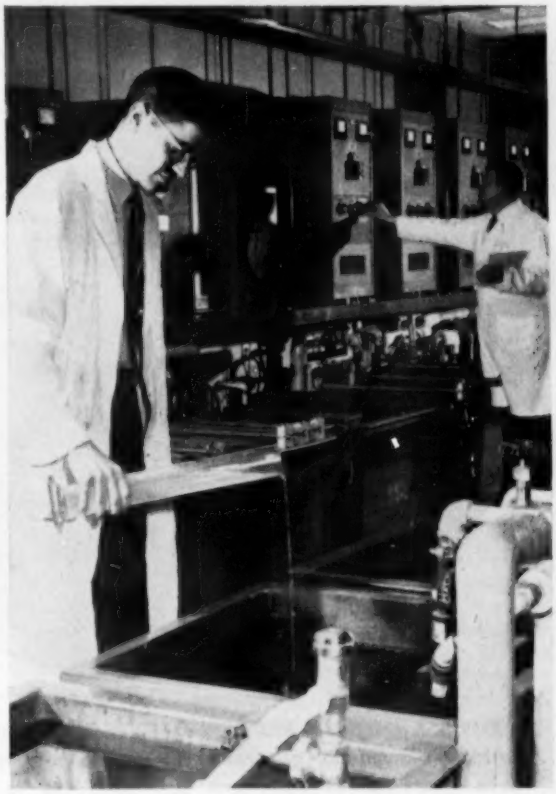
Wyandotte's new research building contains the latest in industrial cleaning equipment —*to help us help you!*

Wyandotte has spent millions of dollars and has more than 63 years' experience building products to give you the highest-quality, lowest "use-cost" metal cleaning obtainable. Now, we've added a new research building to project the performance of these fine products to your future requirements.

Wyandotte's new research building houses complete and up-to-date metal cleaning laboratories. There are cleaning and plating tanks, a multistage spray washer, the latest equipment for working with radioactive tracers, burnishing barrels, polishing and buffing lathes, and a variety of other equipment. All are used in the development and evaluation of metal cleaners, paint strippers, acid treatments, spray booth compounds, phosphating compounds, and aircraft and railroad cleaners of all types.

Our metal cleaning research and product development methods, already extensive and probing, will be further strengthened. You can be sure that every Wyandotte product you use has been research developed, thoroughly laboratory tested in production size equipment, and exhaustively field checked!

The new facilities will also enable us to handle your individual problems even faster and better than before. The services of our trained technical representatives are always available. Let them be the link between your plant and our new research facilities, to help give you better, lower-cost metal cleaning. Call Wyandotte today. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Angeles 12, California.*



A number of the 18 cleaning and plating tanks, with separate rectifiers, in Wyandotte's new industrial pilot lab. This equipment provides an opportunity to study cleaning before copper, nickel, chrome, cadmium, lead, zinc and silver plating. Test pieces may be taken through any desired cleaning and plating cycle in order to evaluate experimental cleaners or solve production cleaning and plating problems.

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Equipment and Supplies

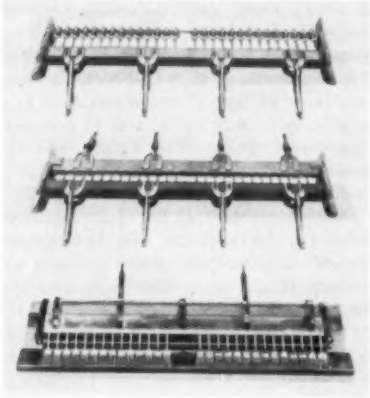
dry, acidic salt mixture which, when mixed in the proportions of two pounds per gallon of water, will quickly remove scale and rust. The solution can be used at temperatures of 70° to 150° F.

Because the material is furnished as a dry salt mixture, it can be safely handled and eliminates the hazards of handling liquid acids and the inconvenience of returnable glass carboys.

Also incorporated in the formulation is an inhibitor and a foaming agent which minimizes the attack of the acid on the base metal and produces a foam which covers the surface of the Quick Pik solution eliminating acid spray and reducing fumes to a minimum.

Information and literature are available on request. Use Reader Service Card.

E—830. New Finishing Jigs—A new group of jigs and fixtures for the mechanical holding of parts being surface finished has been introduced by Clair Manufacturing Company. Designed for use with Clair surface finishing machines, the group includes work holders and layout jigs. Primarily, they are used for holding items such as silverware, but they can be adopted for holding hand tools and other products.



Basically, the holding fixtures consist of: a framework for mounting in surface finishing machine, a clamping device for holding the items to be surface finished, and a provision for supporting heavy-ended items such as spoons. For more information use Reader Service Card.

E—831. New Pocket Comparator—The new, low-price Edscorp Pocket Comparator offered by Edmund Scientific Corporation, Barrington, N. J., for fast, accurate measurement and inspection of small parts and small dimensions is said to be an invaluable aid to machinists, tool and diemakers, production engineers, and lab technicians.

Only about 1½ x 2 inches in size, this handy, imported comparator gives 6 power magnification. Its reticle is calibrated to measure angles, radii, circles and linear dimensions, in both decimal inches and millimeters. For more information on this product use Reader Service Card.

E—832. Industrial Heat Exchangers with Graphite Tubes—The Industrial Filter & Pump Manufacturing Company, 5900 W. Ogden Ave., Chicago 50, Ill., announces that its line of heat exchangers is now available with impervious graphite tubes in addition to the variety of metal tubes previously used. The graphite tubes can be had in both the tube-and-shell type and the tube-bundle type heat exchangers. By combining any number of tubes, Industrial heat exchangers can be supplied to meet any heat-transfer area requirement. With a choice of graphite and metal tubes a heat exchanger is now offered that is ideally suited to heating and cooling any solution used in pickling rooms, any plating solution, and any solution heating and cooling requirement in the processing industries. For more information use Reader Service Card.

E—833. New Copper Purifier—A new copper purifier, which eliminates the need for periodic dumping of copper plating baths by removing harmful solution breakdown impurities and converting them to useful cyanides, has been announced by Sel-Rex Precious Metals, Inc., of Belleville, N. J. The material is a concentrated solution of pure salt prepared especially for use in cyanide copper plating solutions. It is an unique product since it adds no impurities to the bath and fills an important need in the copper plating field.

The copper purifier precipitates carbonates, chromates and sulfates as a heavy, dense insoluble precipitate while converting them to useful cyanides. The precipitate can be filtered out, or the solution can be decanted off the precipitate. For complete information, use Reader Service Card.

E—834. Simple Method of Removing Zinc Deposits from Deburring Stones—The Magnus Chemical Company, of Garwood, N. J., has perfected a simple method of removing the metallic zinc coating which deposits on deburring stones when zinc die castings are barrel-deburred. The experience of a mid-western barrel finishing shop is typical.

Here the deburring medium is a synthetic white stone. It took nearly an hour and a half of tumbling with caustic soda to remove the zinc deposit.

Now with Magnus D-Scale-R the chips are completely cleaned in 20 minutes.

D-Scale-R is a solid, inert material which does not produce acid action until dissolved in water. Hence it is safe to ship, handle and store, with none of the hazards of raw mineral acids. It is inhibited against harmful acid action. For more information use Reader Service Card.

E—835. Tilter Offers Safe Method for Pouring—This new tilter was designed to meet the needs for a smaller, more simplified, less expensive unit suitable for handling 5 and 6½ gallon containers.

It prevents accidents caused by spilling, splashing and carelessness in pouring liquids. A chain is provided to hold the container in position when tilted.

For complete information on this unit use Reader Service Card.

E—836. New Distributor for Abrasive Belt Splicer—Sales and distribution of the recently improved Econaway abrasive belt splicer are now being handled by Aget-Detroit Company, 801 Main St., Ann Arbor, Mich.

The low cost splicing apparatus permits users of large numbers of abrasive belts to effect marked reduction in belt costs while avoiding the keeping of heavy inventories of finished belts on hand. Costs of certain size abrasive belts can, in many instances, be reduced by over 50 per cent with the improved splicer, it is claimed. For more information use Reader Service Card.

E—837. New Heavy Duty Protective Coatings—New formulations which can be spray-applied to produce extra-thick chemical-resisting coatings on steel and other metals have been developed by United Chromium, Incorporated. These products, identified as Unichrome 5300 Coatings, are used to protect equipment against acids, alkalies, salts, oxidizing agents, and many other corrosives.

The coatings permit spray application of films of much greater thickness than has been obtainable in the past. The new coatings, used at room temperature, can be applied to cold vertical surfaces to produce single coat dry films up to 20 mils thick.

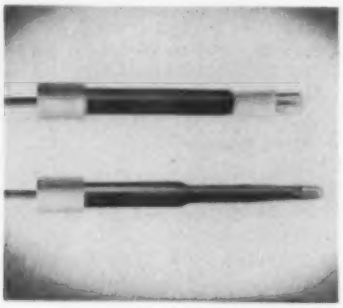
Strong mineral acids such as hydrochloric acid and sulfuric, alkalies such a sodium and potassium hydroxides, water, salt solutions, oxidizing and reducing agents, and many wetting agents do not attack Unichrome 5300 Coatings.

Equipment and Supplies

In the short time they have been available, Unichrome 5300 Coatings have been used for tank and duct lining work in the plating industry. The manufacturer states that the coatings may be used to protect many other types of equipment in the chemical, pharmaceutical and metal working industries.

Other information may be obtained through use of Reader Service Card.

E—838. New Large-Area Metallic Electrodes—Industry's growing use of oxidation-reduction potentials has led Beckman Instruments, Inc., to develop a new series of large-area metallic electrodes pointing to greater benefits from this important control technique than ever before.



The electrodes offer broad surfaces of metal—platinum, gold, silver or nickel—mounted in three basic styles for all kinds of industrial and laboratory service. Their larger sensing area assures fast response, minimized polarization effects, easier cleaning and maximum thermal stability.

Of rugged construction, the electrodes will withstand temperatures to boiling or above. They can be used with any Beckman *p*H meter or automatic titrator.

Further information on the new metallic electrodes can be obtained from Beckman Instruments, Inc., South Pasadena 1, Calif., through requests for Electrode Catalog 86-72 or through use of Reader Service Card.

E—839. Chromic Acid Recovery Method—The Barnstead Still & Sterilizer Co., Boston, Mass., has developed a process whereby rinse water can be passed through ion-exchange resins to effect nearly 100 per cent chromium recovery. The advantages to the plating shop are twofold. First, the troublesome chromic acid waste disposal problem is eliminated. Second, the expensive and often scarce chromic acid is recovered for reuse.

In the process, the rinse water is first passed through a cation column to remove aluminum and copper and then through an anion resin bed which removes the chromic acid. The chromic acid is then recovered in the regeneration process. Tests show that the same resins can be used economically for 100 or more cycles.

For more information write to Barnstead Still & Sterilizer Co., 228 Lanesville Ter., Forest Hills, Boston 11, Mass., or use Reader Service Card.

E—840. Acid Resistant Coating—An acid resistant coating called Oncrete protects plating tanks, fume hoods, floors, walls, interior construction, roof trusses, sash and structural work in plating rooms from the damaging effects of acid fumes and the action of acids themselves.

Oncrete was originally developed as an alkali-resistant, moisture-repellent coating for use on concrete and porous masonry surfaces.

The material is being successfully used in a number of Chicago plants. In one test an area of a concrete floor was protected with several coats of Oncrete. Another was left unprotected. Muriatic acid and chromic acid when dropped on the unprotected concrete immediately made small holes. The Oncrete coated floor surface showed no damage whatever when the acids were dropped on it.

In this particular plating plant, the product is being used on tanks, floors, walls and roof trusses. For more information use Reader Service Card.

E—841. New Rectifiers—American Rectifier Corporation, 95 Lafayette St., New York, have announced that standard unit rectifiers, from 3 kw to 50 kw, are now in stock, available for prompt delivery.

Designed to convert a-c to d-c at the flick of a switch, American rectifiers are capable of producing anything a motor generator set can—and have long been known for their trouble-free operation and long life. These advantages are credited by the manufacturer to the absence of brushes, bearings, foundations, rotating windings, glass or metal tubes . . . plus the fact that no warm-up period or maintenance is required. For additional information use Reader Service Card.

E—842. New Safety Solvent—A new, low-toxicity safety solvent replacing carbon tetrachloride is announced by Tect, Inc., of Dumont, N. J. Designated as Tecsolv 383, the solvent is non-inflammable, fast evaporating and exceedingly low in toxicity. It may be used with vapor concentrations in air 10 to 20 times those permissible with carbon tetrachloride. It is a clear, colorless liquid with a pleasant odor and is the most recent of 20 different safety solvents developed by Tect, Inc., to replace carbon tetrachloride and other dangerously toxic or inflammable solvents such as chloroform, petroleum naphtha, benzol and others. For further information use Reader Service Card.

E—843. Aluminum Cleaner—A new basic discovery in aluminum industrial cleaning—an alkali compound that will not etch or discolor aluminum, yet is so powerful that it will thoroughly spray wash the most difficult type of heavy cleaning, is announced by the Van Straaten Chemical Company, Chicago, Ill.

The new compound is not toxic, is not inflammable and cleans thoroughly and quickly.

It has been safely used on all aluminum and zinc alloys without etching or discoloration and also will not tarnish or discolor other non-ferrous metals such as brass, copper, and bronze. For more information use Reader Service Card.

E—844. Alka-Strip—A new addition to their line of multi-purpose paint strippers and cleaners has been announced by the Whitfield Chemical Company, Dept. 23-C, 14225 Schaefer Highway, Detroit 27, Mich. The new remover is sold under the trade mark Alka-Strip.

Used for chemical stripping of organic finishes and complete removal of pigmented-primer residues from steel, zinc, and magnesium, the new material can also be applied for deflocculation of paint overspray, cleaning Bonderite systems, and removal of abrasive, lapping, or burnishing residues.

This latest Whitfield remover comes in powder form; water soluble, non-inflammable, it does not foam or cake. For more information use Reader Service Card.

E—845. Temperature Testing Chamber—A new line of multi-range, all-purpose test chambers capable of producing low temperatures to −130° F, high temperatures to 200° F and a standard humidity cycle of 20 per cent to 95 per cent from +35° F to +185° F, has recently been introduced by Murphy & Miller, Inc., 1326 S. Michigan Ave., Chicago, Ill.

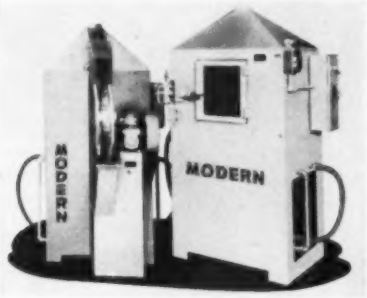
Made in 5 sizes with test space capacity from 4 to 36 cu ft, the new units incorporate many unique features designed to provide faster, easier and more accurate testing.

The units are completely internally wired, piped and laboratory tested before shipment. Connections to plating water and drain connections may be made with simple flexible connections. For additional information use Reader Service Card.

E—846. Strippable Liner for Vacuum Coating Tanks—National Research Corporation, 70 Memorial Dr., Cambridge, Mass., now offers Narliner strippable liner for vacuum coating tanks. In the vacuum metallizing process the interior of the coating tank becomes covered with successive layers of evaporated metal. This material is difficult to remove and outgasses badly when the tank is evacuated, thus increasing the pump-down time. By coating the interior of the coater with

Narliner strippable liner, these metal accumulations can be removed periodically by merely stripping the plastic coating away from the coating tank and short metallizing cycles are thus maintained. For more information on this product use Reader Service Card.

E—847. Soft Metal Parts Deburred Rapidly—Fast production deburring of soft metal parts, using either a continuous rotating process for small parts or a stationary clamping arrangement for



larger units, is possible with two standard Maize Blast machines developed by Modern Industrial Engineering Company, 14230 Birwood Ave., Detroit 4, Mich. Both standard machine types are designed to remove light burrs from metals in the range of aluminum to mild steel. In both models, maize or a similar soft material, is blasted against the parts under factory airline pressure. These machines are specially suitable to deburring parts that would be damaged by tumbling. For more information on this equipment use Reader Service Card.

E—848. Self-Priming Filter Pumps—Sethco Manufacturing Company reports a number of additions to its line of filter pumps for filtering corrosive solutions, namely, Models LSIN-5 and LSIN-10. The new pumps are suggested for use with practically any acid or alkaline solution from *p*H 0 to *p*H 14; may be used for filtering non-aqueous solutions. The filters will remove particles down to 1 micron in size.

Pumps are self-priming and have a suction lift of approximately 15 feet. They are fabricated of 316 stainless and have neoprene impellers. The filter assembly is fabricated of high temperature lucite and is also available in Haveg, 316 stainless, rubber lined or epoxy resin construction. For additional data use Reader Service Card.

E—849. Welding and Machining of Hard Vinyl Plastics Advanced—Two recent Lucoflex developments promise to widen the already extensive field for non-plasticized hard vinyl plastics. Welding rods of triangular cross-section, 0.20 and 0.28 inch on a side, expedite the welding of large assemblies such as chemical sinks and corrosion resistant fans; and solid bars up to 2.5 inches in diameter and of uniform density permit the machining of components for all-Lucoflex units. Until the present time, size limitations were imposed by difficulties in welding and machining these plastics.

Heretofore, the welding of plastics was a costly and time consuming operation. In any but the narrowest seams, filler material was required and only repeated passes produced satisfactory seams. The new triangular welding rods produce tight seams without filler materials and with a single pass. Economies of 80 per cent are visualized in time alone; materials costs are expected to be reduced by 50 per cent. For more data use Reader Service Card.

E—850. Gold and Rhodium Package Plating Unit—Technic, Inc., announces the development of a complete fully controlled package unit for the precision plating of gold and rhodium.

This unit suitable for other specification or decorative plating has a capacity of 40 gallons and offers for the first time fully automatic timing, heat control, individual power source and indicating metal replenishment control. Standardized soluble gold and rhodium of the highest purity for use with this unit are also offered as well as details on the procedure for plating any thickness of gold, gold alloy or rhodium including full analytical procedure.

Complete details are available upon request to Technic, Inc., 39 P Snow St, Providence 1, R. I., or through use of Reader Service Card.

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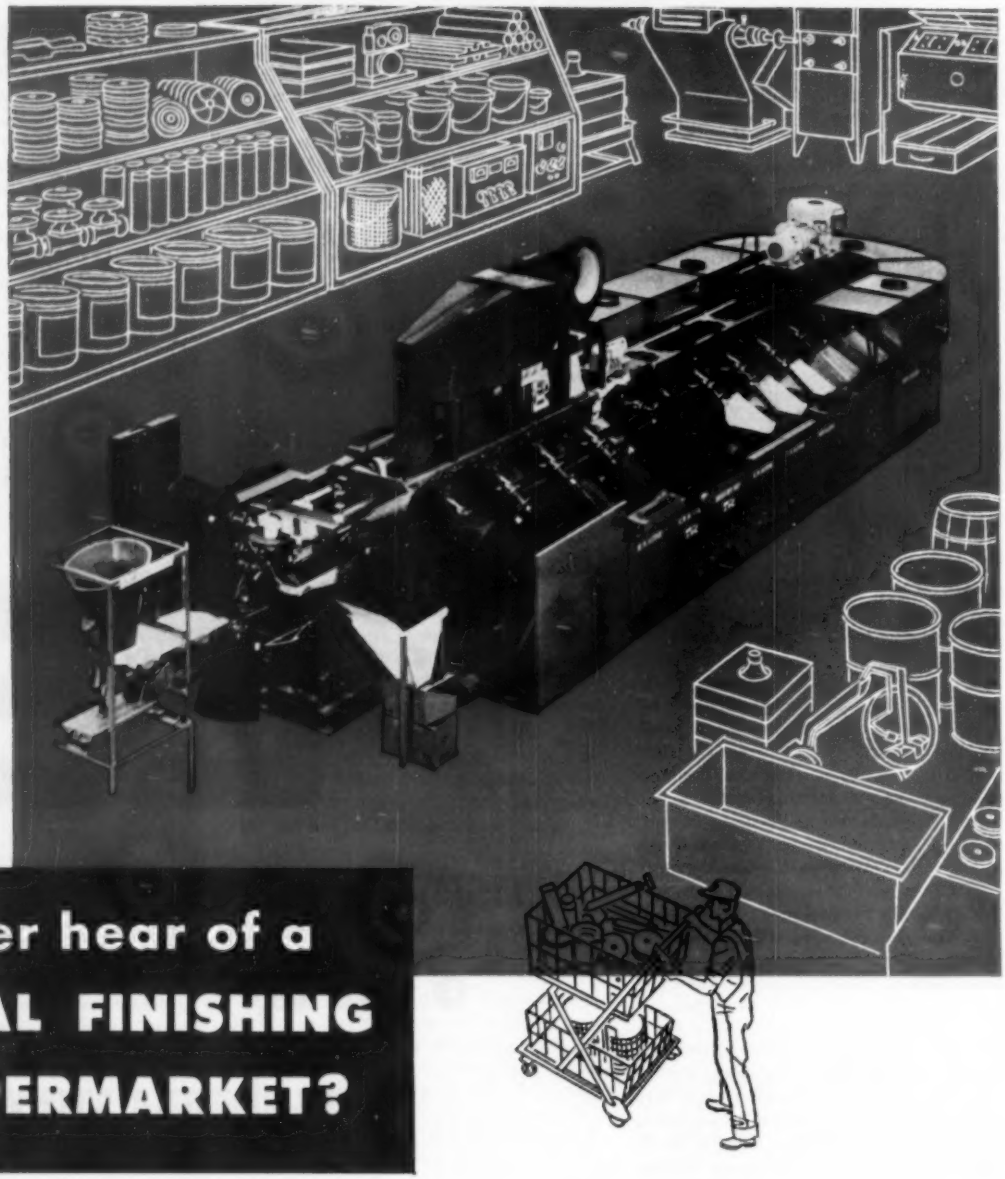

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plating

AUGUST, 1953

Dedicated to the improvement and dissemination of the knowledge of the arts and sciences of electroplating and of finishing of metals and of allied arts.

VOL. 40, No. 8

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Editorial

Another Milestone

THE PUBLICATION in this issue of the four papers presented during the initial educational session of the recent Annual Meeting is the result of the policy endorsement granted by the Delegates. All the papers presented at Philadelphia will be published in a similar manner, with discussion, in the succeeding issues of this journal.

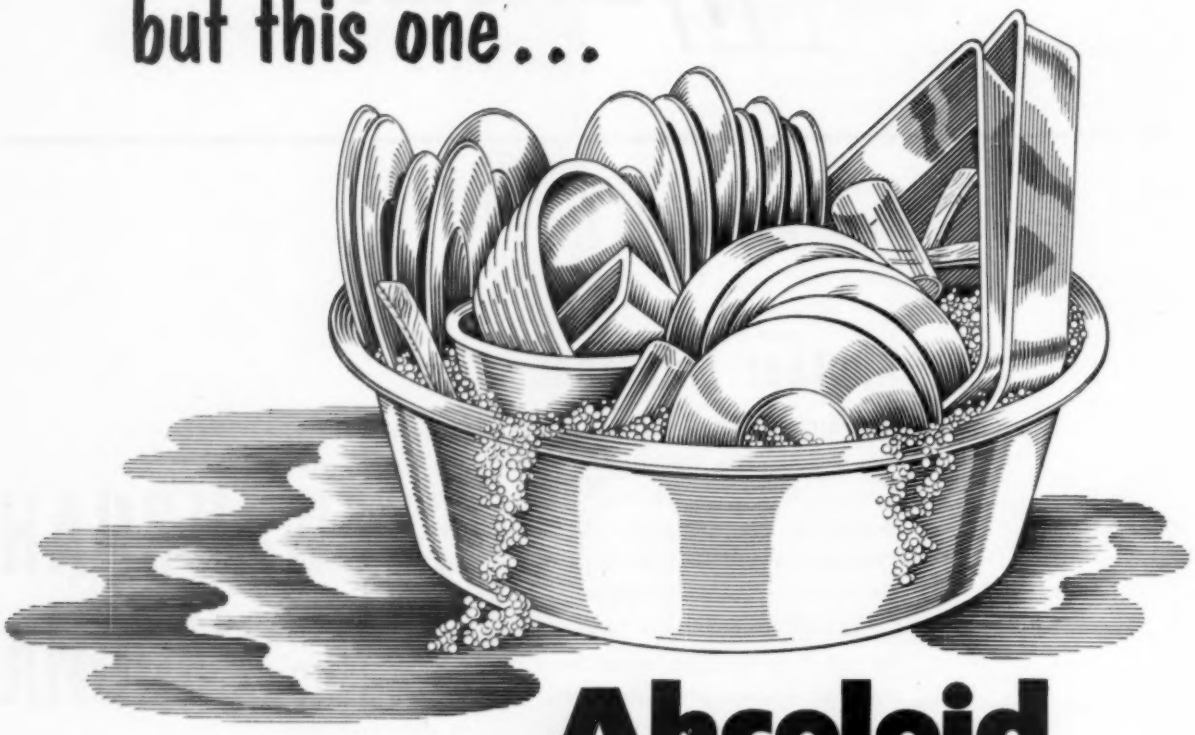
The net result of this new policy is the elimination of the usual six to eight month wait prior to publication of technical sessions proceedings that was experienced in the past. The current issue marks the earliest date ever that Convention Papers have been published, and at the same time includes the valuable discussions that followed those papers.

The value of such early publication is unquestioned to those five thousand members who could not attend the Meeting. To those that were present, the benefit lies in the fact that they are now able to study the subject matter more thoroughly, much sooner.

In addition to the above, and as outlined in Dr. Ralph Schaefer's editorial in the March issue, the papers will be published as a bound volume of *Proceedings*, ready for distribution by the end of the year. The 1954 *Proceedings* will include the New York Convention Papers and, it is planned, in addition, to include those technical articles usually presented in this journal.

Al Korbelak

for EVERY CLEANING JOB but this one...



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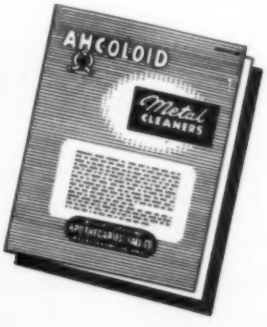

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BRIGHT GOLD PLATING*

EDWIN C. RINKER†

Gold plating is becoming increasingly important in many branches of industry for applications which require decorative or protective finishing, or a combination of both.

The value of gold for these purposes lies in the remarkable properties of this noble metal.

Its low electrical resistivity, high resistance to tarnish and oxidation, resistance to attack by most chemicals, and its protective qualities when applied as electrodeposit in thin coatings over base metals account for its more extensive use.

It is the purpose of this paper to describe a recent development in the precious metal electroplating field, namely, a bright gold plating process.

This new procedure was developed to overcome the acknowledged disadvantages of gold plating—high cost, softness of deposits and lack of modern high speed mass production methods that compare with the modern electroplating baths for nickel, copper and silver. The new process wipes out some of the high costs of regular gold plating by eliminating buffing and scratch-brushing losses, and by producing greater uniformity of deposit distribution it adds further savings that are not possible with conventional plate. The bright deposits are harder and thus impart extra wear resistance to plated parts. Because of these features the process is an ideal one for specification plating.

Bath Composition

	oz/gal	gms/liter
Potassium cyanide	10.7–12	80–90
Metallic gold as a complex salt (troy)	1	8
Brighteners which are inorganic complexes of noble metals	1.6	12

The bath has such a wide bright plating range that the free cyanide and the metallic gold content can be kept within ±20 per cent of the above concentrations. The brighteners are stable and will not decompose in storage, in solution or during electrolysis.

It is advisable to mention that this bath formulation is set forth in the author's application pending before the U. S. Patent Office and assigned to Sel-Rex Precious Metals, Inc.

Equipment and Operating Conditions

1. *Tanks*

Tank materials may be stainless steel, Lucite, enameled steel, Pyrex glass or Fiberglas. The use of stainless steel is preferred for many reasons. It is sturdy, reasonably priced, can be made to exact dimensions and, with a false compartment, will conveniently provide temperature control without heating or cooling coils. (See Fig. 1.) Further, the tank itself can be used as the anode.

2. *Temperature*

The temperature of this bright gold solution can be varied over a wide range. Temperatures as low as 44° F and as high as 90° F have been used with good results. A temperature range between 60° F and 70° F is preferred as this temperature provides the optimum results in brightness, ease of temperature control, and low decomposition of the cyanides. Generally, temperatures at which conventional gold solutions are operated are considerably higher, on the order of 140–160° F which presents the additional problems of evaporation losses, solution level maintenance, cyanide decomposition and carbonate buildup.

3. *Agitation*

Moderate to rapid agitation is essential to secure bright deposits. In small installations, rapid stirring of the solution with mechanical stirrers is satisfactory. If new installations of reasonable sizes are to be made, the agitation method shown in Fig. 1 is highly recommended. This requirement is not a drawback to the process, since agitation is preferred in practically all plating solutions.

4. *Anodes*

Stainless steel anodes of all types can be used. An

*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 15, 1953.

†Technical Director, Sel-Rex Precious Metals, Inc., Belleville, N. J.

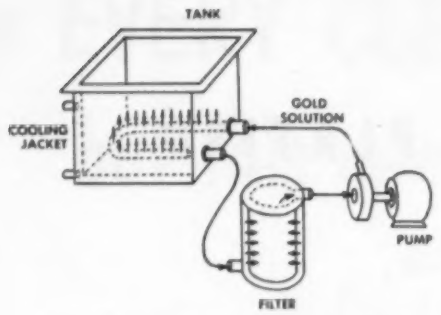


Fig. 1. The sketch shows a working diagram of a gold plating unit in which the solution is automatically filtered and agitated. Inasmuch as most gold plating units are relatively small in volume the need for cathode rod agitation, an awkward arrangement, is eliminated

anode-cathode ratio of at least 5 to 1 is necessary as a minimum with a higher one of 10 to 1 being recommended. When stainless steel tanks are used, the tank should be made the anode. These ratios are comparable to those of several contemporary gold baths where an anode to cathode ratio of 5 to 1 is generally used.

5. *Filtration*

Filtration is of utmost importance to insure successful operation of this process where thicknesses of 0.00025 inch or better are required. Solid particles and organic matter will tend to cause roughness or cloudiness in the deposit. Intermittent filtration is necessary; continuous filtration will provide the ultimate in quality of the deposit. Carbon may be used in the filter without deleteriously affecting the solution. Again, a direct comparison with regular gold solutions is made. Though it is common practice with the latter type solution not to filter, best results arise from the use of filtered solutions.

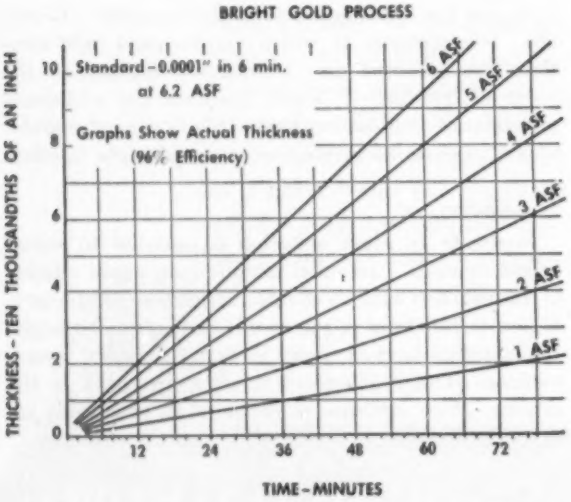


Fig. 2. This graph can be useful for determining the time requirements at given current densities to deposit a specified thickness. The graph can be used for conventional gold plating as well as for bright gold

6. *Current Density*

A current density up to 6 asf can be used. However, a current density range of 3 to 5 asf is the optimum range; one that is about the same as that of conventional gold plating baths.

7. *Cathode Efficiency*

The cathode efficiency of this process is quite high. The efficiency varies between 95 and 96 per cent. This is in line with a conventional bath operating under rigid control of temperature, current density and a high metal concentration. The chart (Fig. 2) can be useful for specification plating, for baths of either bright or conventional gold, though it is generally recognized that the greater thicknesses for the conventional bath will require frequent removal and scratch brushing for best results.

Precautions

There are several factors that should be mentioned at this point when using the bright gold system.

1. The work entering the bath must be perfectly clean, otherwise cloudy or rough deposits will result.

2. On metals such as brass, copper, or nickel a prior flash deposit of a regular gold is desirable for perfect adhesion.

3. Organic contamination, dust, dirt, or metal particles will cause roughness, dullness or non-adherent deposits or all three.

4. Work that has been plated must be given a thorough rinsing in cold water. A thorough soak in a 5 per cent acetic acid followed by a five-minute soak in clean boiling water will leach out the cyanide solutions and prevent spottiness, staining, or tarnishing at a later date. This treatment is particularly advisable on work having an undercoat of silver.

These requirements are stricter than those of a regular gold solution but wholly in line with bright plating operating conditions of electrolytes of other metals such as nickel.

Characteristics of the Deposit

This process has been in commercial operation for over a year. During that period of time the initial observations that were made by the author, relative to the bath characteristics of greater throwing power, corrosion resistance and hardness of deposits, have all been verified by investigations of independent laboratories. It is now possible to present these factual data.

They are by no means complete, and more exact and complete information will be published in the near

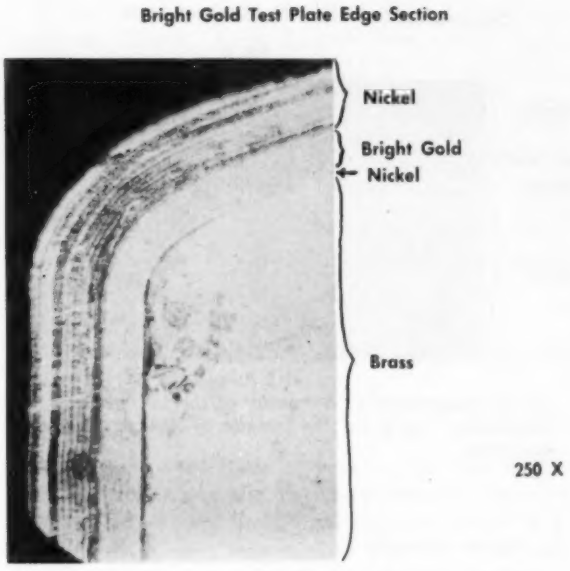


FIG. 3

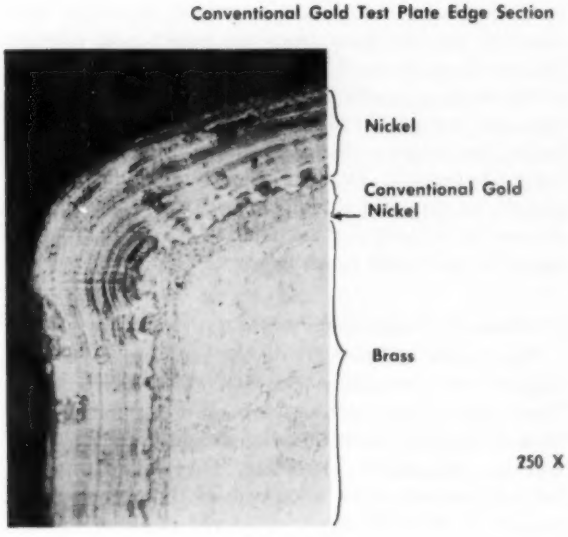


FIG. 4

Figs. 3 and 4. Photomicrograph Fig. 3 depicts the smooth, even buildup of bright gold on an extreme corner of the brass test plate, as compared to the nodular growth in Fig. 4 made from a conventional bath.

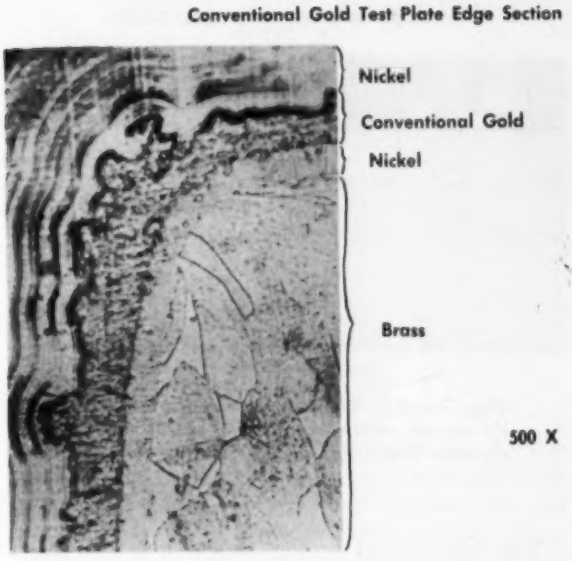


FIG. 5

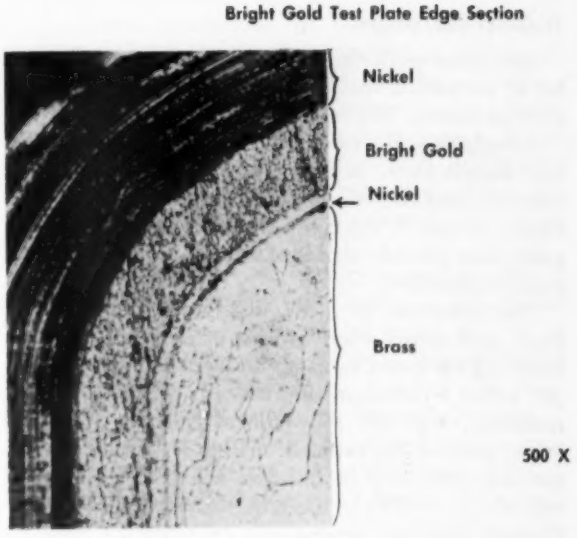


FIG. 6

Figs. 5 and 6. The lines in the bright nickel overplate clearly define the marked difference in the surface characteristics of the conventional versus the bright gold deposit.

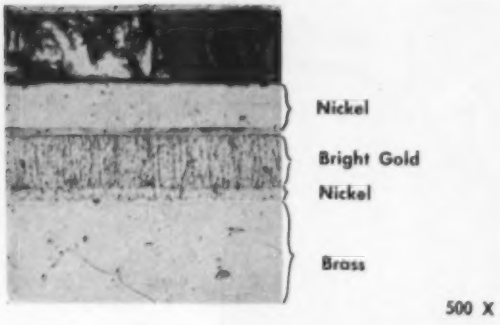
future, for the characteristics of the deposit are being studied continually.

A number of brass plates 2 x 3 inches were prepared by polishing, nickel plating and buffing to a high finish. These plates were then plated with equivalent thicknesses by weight of gold both from a conventional and the bright gold electrolyte.

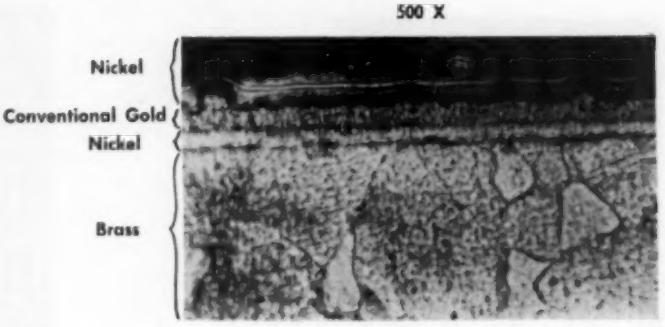
A conventional bath formulation of the following composition was used.

Metallic gold as potassium gold cyanide	1 oz
Potassium cyanide	2.5 oz
Potassium carbonate	2 oz
Water to make	1 gallon
Temperature	150° F
Agitation	Moderate to rapid
Current density	As stated in each case for comparison

Bright Gold Test Plate Center Section



Conventional Gold Test Plate Center Section



Figs. 7 and 8. The center section further illustrates the smooth, even surface of the bright gold electrodeposit. The rough, nodular, uneven surface, while not as exaggerated in the center of the test plates, nevertheless bears out the results of the surface analyzer.

The ame current density (5 asf) was used in all cases. These prepared samples were examined with the following results:

1. *Metal Distribution*

After cross-sectioning the extreme edge and the center of the plates, the thicknesses of the gold deposits were measured. The results are given in Table I.

Disregarding the rough and nodular growth of the gold deposit shown in Figs. 4, 6, and 8, as distinguished from the smooth uniform deposit of the bright gold in Figs. 3, 5, and 7, the ratio of the thickness of the deposit from extreme edge is of importance from an economic standpoint.

This difference in metal distribution will be still more pronounced where objects of irregular shape or those with recessed areas are to be plated. For example, where a minimum thickness is specified it will be necessary, with the conventional gold, to apply an excess plate on the exposed surfaces in order to assure sufficient thickness in recesses; whereas, bright gold will give a relatively uniform thickness throughout. Further, auxiliary anodes may be dispensed with in many instances.

TABLE I. RESULTS OF METAL DISTRIBUTION MEASUREMENTS*

	Bright Gold Plate	Regular Gold Plate
Edge section (extreme edge)	0.001	0.00075–0.00125
Center section	0.00075	0.00037
Metal Distribution Ratio (edge to center)	1.3	2–3.4

*Thickness of deposits given in inches

2. *Surface Analysis*

Surface analysis measurements were made of both bright gold and conventional gold deposits. Results are given in Table II.

In examining the photomicrographs, it can be seen that the electrodeposit from the bright gold solution follows the contour of the basis metal without appreciable build-up on the sharp edges. While the deposit does not tend to level or brighten an otherwise dull finish, the features described above produce two distinct advantages. One, the deposit will not build up nodules on threaded parts; and two, it will not alter or deform the original surface detail of engravings, engine turnings, or scratch brush finishes.

3. *Hardness Comparison*

The figures in Table III on the hardness of the gold deposits are reasonably accurate. They give a good illustration of the relative hardness of the two plates. Several readings were made on bright gold deposits, and they ranged from 114 to 116. The readings on regular gold deposits were a little more difficult to make because of the difficulty encountered in obtaining satisfactory thick deposits from a regular bath. The measurements that were made on regular deposits were made on the cross section.

The practical applications on such items as watch bezels and electrical contacts of all types show the hardness to be of great advantage.

Conventional gold, being relatively soft and dull, tends to gall readily on sliding contacts. The smooth, hard surface of bright gold deposits eliminates galling and has good "slip" characteristics.

4. *Salt-Spray Tests*

Electrodeposits of 0.0002 inch on highly buffed brass were exposed to salt-fog tests as per the A.S.T.M. tentative method B 117–49T.

Exposures up to 200 hours and more without visual breakdown of the deposit were not unusual.

However, on certain specimens light colored salt products formed. These encrustations, though light, would cling to the regular gold plated specimens; whereas, with bright gold plated specimens, the surface would be relatively free of the salt product. While this in itself is an advantage of bright gold it does not necessarily prove superiority from a protection standpoint. Results of salt-spray tests reported by other investigators on runs made on their own products show a marked similarity to those obtained by the author.

5. *Electrical Characteristics*

The electrical conductivity of bright gold is equal to that of the conventional gold.

6. *Internal Stress*

Stress tests were made of both regular and bright gold deposits, using the Brenner-Senderoff Contractometer. In all cases the results obtained showed that gold deposit stresses were expansive rather than compressive. Repetitive values were not obtained.

7. *Abrasion Tests*

A research model Taber Abraser employing CS-10 abrasive wheels with a 500-gram load was used in checking the relative wear-resistance of identical deposit weights of conventional gold and bright gold.

The initial break-through of bright gold plate was noted at 3300 cycles, whereas the conventional gold plate broke down at 2400 cycles, indicating the wear-resistance of the former to be approximately 40 per cent superior.

This superiority is further shown by the fact that after 9000 cycles of abrasion on the test plates the bright gold plated specimens exhibited an exposed area of less than 10 per cent, whereas, those with a conventional gold deposit showed an exposed area of over 40 per cent.

Tests were made on a thickness of 0.0002 inch gold in each case.

Barrel Plating

The many advantages of the electrodeposit itself, plus the throwing power and elimination of burnishing, account for the extensive use of the bright gold process for barrel plating. The conditions for operation are identical to rack plating. The rotary motion of the barrel and the movement of the work are sufficient agitation for good results.

Advantages of the Bright Gold Process

During the brief period that this process has been available commercially, the ever-increasing number of users have experienced the following advantages from its use.

1. Elimination of scratch brushing and buffing or both: Since the deposit follows the contour of the underlying basis metal, it is feasible to produce mirror-bright deposits of 0.001 inch or higher.

TABLE II. SURFACE ANALYSIS RESULTS

	Bright Gold Plate	Regular Gold Plate
	micro inches rms	
Extreme edge*	1.5–2	60
Center section	1.5–2	10
Extreme edge†	1.5	7.0–8.0

*Average thickness of deposit, 0.001 inch
†Average thickness of deposit, 0.0005 inch

2. Better metal distribution: In the plating of waveguides, radar parts and many complicated electronic components where the significant surfaces are the deeply recessed areas, bright gold deposits have proven themselves to be vastly superior to conventional gold deposits. On small parts that are barrel plated, the ability of the new process to plate in blind holes is decidedly pronounced.

3. Abrasion resistance: The hardness, the non-galling property and the slip characteristics of bright gold are of great benefit in the plating of sliding and wiping contacts, jack plugs and other electrical contact items.

4. Uniform color: Because the appearance of bright gold deposit never varies from a bright uniform 24 karat color, it is of great value wherever color is important whether the parts are of a jewelry, novelty or industrial nature.

5. Corrosion protection: As this process provides a fine grain, dense deposit with unusually good metal distribution, the protection offered would tend to be greater than an equivalent weight of gold deposited from a conventional bath, though it is well to remember that noble metals protect regardless of thickness.

6. Simplicity of operation: The operation of the bath at room temperature has many advantages such as (a) cyanides will decompose more slowly; (b) stop-off materials are less prone to lift if exposed in room temperature electrolytes rather than in high temperature baths.

7. Economics: The above listed advantages point up the economic suitability of the process. A number of manufacturers have kept detailed records on the costs of "flash" plating for decorative purposes. They

TABLE III. HARDNESS COMPARISON OF GOLD DEPOSITS

	Bright Gold Plate	Regular Gold Plate
Knoop Hardness Number	85.5	47.5
Tukon, converted to Vickers	116	65

report that on such items as trophies, diecast ornaments for automobiles, the comparative cost figures between conventional and bright gold show a realistic economical advantage in favor of the latter.

Present Applications

Bright gold is being used on a wide variety of products.

In the decorative field it is used on jewelry, eyeglass frames, watch bracelets, razors, novelties, trophies; and in the automobile industry on decorative ornaments. In these instances the deposits used are from 0.000002 inch to 0.000010 inch in thickness.

On such items as watch case bezels, better quality eyeglass frames, cigarette lighters, pen and pencil caps and barrels the deposits are from 0.00005 inch to 0.0015 inch thick.

Aside from the beauty of the finish, the increased wear-resistance and corrosion protection offered by the deposit warrant the added intrinsic value of the gold.

In the industrial field all types of electrical contacts, springs, waveguides, electronic parts, instruments, watch parts, instrument cases and many other items are being produced in large volumes.

Conclusion

Having already been accepted as a much-needed tool in the electronics field, this process is finding ever-increasing uses in other fields because of its simplicity, ease of control and uniformity of results.

In many cases where gold clad or platinum clad containers, contacts, valves, etc., are used, bright gold may be used as a replacement and allow greater usage of precious metal surfaces because of less cost. In the chemical processing field, there have been several instances where large vessels are being plated with a reasonable thickness of bright gold to prevent corrosion of the basis metal and provide a surface that will not contaminate the various chemical mixtures in process.

For jewelry and novelties, the inherent disadvantages in manufacturing rolled gold plate and gold filled products—the ever-present raw edges, rupture of the gold filled layer and removal of the greater portion of the gold filled layer through abuse in drawing and polishing operations or both—make bright gold a practical replacement because of its many favorable aspects.

Tremendous savings can be effected in the manufacture of high quality watchcase bezels where a great deal of labor is involved in drawing, soldering, filing, etc. Now, the intricate parts can be either electroformed or die cast and plated to the required thickness. In some cases where solid gold electroformed articles are required, it is entirely feasible to electroform with this process.

The merits of this process on luxury items such as lighters, watch cases, high quality costume jewelry are being evaluated by additional manufacturers and many of them are adapting the process to take advantage of its many favorable aspects.

Acknowledgments

The author wishes to acknowledge the helpful suggestions and comments offered by the following: Mr. R. A. Ehrhardt, Bell Telephone Laboratories, Inc., Summit, N. J.; Mr. C. K. Turner, American Safety Razor Corp., Brooklyn, N. Y.; Dr. K. Schumpelt, Forstner Chain Corp., Union, N. J.; Mr. W. H. Deterding, Bendix Aviation Corp., Kansas City, Mo.

DISCUSSION

Mr. George F. Herrmann (Ronson Art Metal Works, Inc., Newark, N. J.): It is suggested to anyone who uses a filter, for agitation or clarification or both, in this application, that they locate their equipment (self-priming pump type) above the solution level to prevent accidental siphoning in case of leakage. Also, a drain pan arrangement should be provided to salvage any drip losses.

Mr. Rinker: I don't want to appear commercial at this time but we do manufacture equipment in which a pump and filter are used for automatically filtering and agitating the solution. This equipment is placed slightly below the level of the gold tank. In addition we have an auxiliary tank built under this whole structure in order to avoid loss of any gold solution through leaks or other causes. We deem this necessary inasmuch as the gold solution costs approximately $40 per gallon.

Mr. Joseph B. Kushner (Joseph B. Kushner Electroplating School, Stroudsburg, Pa.): What is the exact percentage of gold in the bright gold deposits?

Mr. Rinker: The actual percentage of gold in this deposit is 99½ per cent. This is comparable to conventional gold where impurities such as copper and other metals are most difficult to keep out of solution under average shop operations, and have been found, at times, to be in excess of one-half per cent. We co-deposit another noble metal with the gold and as in the making of steel—when a trace of one or more elements is added to iron, the resulting alloy has many physical and metallurgical properties which make it vastly superior to iron. We have followed the same reasoning, and have developed an electrodeposit of gold which provides superior properties to that of conventional gold.

Mr. Fred Nobel (Lea-Ronal, Inc., New York, N. Y.): How does the wear resistance of the bright gold compare with that of 10 karat rolled gold plate on the Taber Abraser?

Mr. Rinker: We have made no tests on rolled gold plate for hardness or wear resistance. Our rea-

soning is this: Each manufacturer anneals his raw material to secure proper softness for his individual manufacturing requirements. Therefore any abrasion tests on rolled gold plate would be variable and meaningless since each lot of metal may have had varied annealing, polishing, and pressing operations. We do have several instances where manufacturers have replaced rolled gold plate with this bright gold process. Their reasoning is this: electrodeposit will be uniformly thick, will require no buffing, and will cover the object completely leaving no raw edges. Further, all mechanical operations are carried out prior to the final plating operation. In many instances the pressing, drawing, or forming operations tend to destroy the rolled gold plate and when followed up by buffing, the cutting through the edges of the part being buffed is experienced quite frequently.

MR. LAWRENCE A. WINCO (Leeds & Northrup Company, Philadelphia, Pa.): What about the preventing of tarnishing of gold plate?

MR. RINKER: The bright gold deposit or a conventional gold deposit will not tarnish. Moreover, as is frequently encountered in the industrial field, specifications call for an extremely thin gold flash deposit over a silver plated object. Any tarnishing that may occur in a day, a week, or several months—we attribute to porous or rough surfaces which tend to trap cyanide solutions. The trapped material leaches out in the course of time, thus causing dark patches on the work which could be mistaken for tarnish of the gold deposit itself. Proper treatment of parts after plating will alleviate this condition to a great degree.

MR. WILLIAM S. MCDOWELL (South Side Plating, Elkhart, Ind.): How were your thickness tests made?

MR. RINKER: Photomicrographically.

MR. A. W. CAGLE (Western Electric Company, Winston-Salem, N. C.): What method is used to replenish the solution? Would some gold anodes be advisable where a large amount of gold plating work is to be done?

MR. RINKER: Gold anodes should not be used for replenishing as part of the process entails the addition of salts, the composition of which is so adjusted that regularly scheduled additions keep the solution in proper balance.

MR. M. R. CALDWELL (Doehler-Jarvis Corp., Grand Rapids, Mich.): What is the best procedure for obtaining adhesion over bright nickel?

MR. RINKER: We recommend applying a gold flash deposit from a conventional flash plating solution. This flash plating solution containing 2 oz/gal of potassium cyanide, 1 to 2 pennyweights of gold is operated at 4 to 6 volts at a temperature of 140 to 150° F. Optimum time of flash plating is maintained at no more than 5 seconds.

MR. JOHN W. COTTONE (American Phenolic Corp., Chicago, Ill.): Have you noticed in your photographic work whether crystalline structure of bright gold is produced by crystals of gold laying one upon another or in a columnar orientation?

MR. RINKER: That particular phase of the physical properties of the deposit was not investigated.

MR. CHARLES GELDZAHLER (Platers Technical Service, Chicago, Ill.): Our experience with the bright gold deposit has been that when a 0.0002 inch thick deposit is annealed at 1400° F in a hydrogen atmosphere it blisters. Is there any accounting for this?

MR. RINKER: Yes, there is. It is the nature of the composition. It will not withstand the high temperatures—I am speaking of temperatures up in the range of 1000° F and higher. The deposit actually does not fail, adhesion-wise, but rather tends to change structurally—developing an appearance about like that of an orange peel effect.

MR. GELDZAHLER: Is the addition agent organic or inorganic?

MR. RINKER: No organic materials are used in the make-up or replenishment of this solution.

MR. WALTER DENNEY (Belmont Casket Company, Columbus, Ohio): In regard to the spotting out of bright gold over silver or spotting out of silver what was the acid dip recommended and its strength?

MR. RINKER: We have performed many tests to alleviate the condition of spotting out and discoloration of gold when applied in thin layers over silver. We have found the following procedure gives good results: thorough water rinsing followed by a 5 minute soak in a 5 per cent acetic acid solution and then a rinse in cold water, and another soak in clean hot water, preferably boiling. Any spotting out that may occur can be removed easily by a simple dip (5–10 seconds) in a 10 per cent sodium cyanide solution used at room temperature. After the cyanide dip, conventional rinsing steps should be observed.

MR. JAMES D. THOMAS (General Motors Research, Detroit, Mich.): How thick can these deposits be plated and how does stress vary with thickness?

MR. RINKER: Well, I have an electroformed part (showing sample piece) that is over 20 thousandths thick. The part is smooth and shows no nodular build up. As to the second part of your question (how does stress vary with thickness), we have not done sufficient work on the stress values of the deposit to present a report at this time. The stress tests were made on ¼ thousandths thick deposits and were inconclusive.

MR. JOHN F. MAXION (General Laboratory Associates, Inc., Norwich, N. Y.): Have you had any experience with gold plating on tungsten contact points?

MR. RINKER: I do not know of anyone using the process for that purpose.

STATISTICAL QUALITY CONTROL—A NEW TOOL FOR THE ELECTROPLATER*

By EZRA A. BLOUNT†

ABSTRACT

Statistical quality control, originated some thirty years ago as a method of inspection through scientific sampling to control quality in the mass production of machine parts to close tolerances, has been applied recently in the electroplating and finishing industries to control process variables such as solution composition, pH, and also to record and control the percentage of rejected parts. By using control charts for certain plating solution variables the operation can be controlled to a closer degree and a saving of plating chemicals can be made. Plated product inspection charts prove the value of close control of plating solutions. Adoption of these systems can reduce rejects and save plating metal. Examples of methods used in two large plating installations are cited.

INTRODUCTION

At the 1951 American Electroplaters' Society Convention held in Buffalo, N. Y., Dr. William Blum, in his keynote address, stated that appreciable further progress in electroplating research would require new tools for the researcher. The same situation applies generally to the electroplating industry, in that new equipment, new processes, new materials—in short, "new tools"—are a continuing requirement. One such new tool, which the plating plant supervisor can employ as an aid in controlling and improving the quality of the plated products, is called "statistical quality control". It deals, essentially, with the inspection of manufactured products or processes, and involves the use of sampling techniques, as well as the laws of mathematical probability in determining mathematically certain probable or "to be expected" variations. It may be described as the heart of scientific manufacturing, the basis for specifications, the means for manufacturing control, inspection, and quality certification.

Progress in industrial or scientific developments has generally followed two avenues of approach. Some discoveries have resulted from intensive research work with the specific purpose of proving an idea or theory, or creating new products or processes. Other equally remarkable developments have resulted from the application or adaptation of ideas or laws of one branch of science or industry to another entirely unrelated branch. The introduction of statistical quality control to the electroplating industry may be classified as an example of the latter type.

STATISTICAL QUALITY CONTROL—HISTORICAL BRIEF

Professor S. B. Littauer of Columbia University has traced the development of statistical quality control in the United States[1], and described the establishment of an Inspection Engineering Department in the Western Electric Company to examine and interpret production inspection data. One of the first men assigned to this group was Walter A. Shewhart, who almost immediately introduced control charts as means of recording inspection data and controlling variations in various product characteristics. He then began his systematic development of the theory and practice of statistical quality control which was well rounded out by 1929. Two books by Shewhart record his work[2] and assist in supporting the general consensus that Shewhart should be credited with the inception and development of the idea of statistical quality control.

An important part of the work on quality control carried on at Western Electric during the years 1924 to 1929 was the development of sampling inspection tables by Harold F. Dodge and Harry G. Romig, under the direction of George D. Edwards[3]. The first set of Dodge-Romig lot tolerance tables was completed in 1926, followed in 1927 by the first average outgoing quality limit tables.

In order to interest engineers as well as statisticians in industrial quality control, there was formed—with Mr. Shewhart as chairman—the Joint Committee for the Development of Statistical Applications in Engineering and Manufacturing, sponsored by the American Society of Mechanical Engineers and the American Society for Testing Materials and joined by the American Statistical Association, the Institute of Mathematical Statistics, and the American Institute

*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 15, 1953.

†Editor, Products Finishing Magazine

of Electrical Engineers. Later a Technical Committee on the Interpretation and Presentation of Data was formed under the sponsorship of A. S. T. M., and the work of this committee led to the publication of the first A. S. T. M. Manual on the Presentation of Data[4].

General L. E. Simon, Ordnance Department, U. S. Army, began work on quality control in 1934. His work was valuable not only for the contributions he made to the practice of quality control[5], but also because he was instrumental in getting the armed forces to promote nationwide use of statistical control in the procurement program. Civilian and military agencies, working together during the war years, spread the gospel of statistical quality control throughout American industry. An example of the continuing interest of military agencies in quality control may be cited in the presentation of a paper, "Practical Implications of the Air Force Quality Assurance Program", by Lt. Col. O. C. Griffith, USAF, at the recent Seventh Annual Convention of the American Society for Quality Control.

During the past few years the idea of applying statistical quality control principles and methods to the electroplating industry has found increasing acceptance. For example, in their study of current distribution in barrel plating, Geissman and Carlson[6] employed statistical quality control methods, and reported their findings at the 39th Annual Convention of the A. E. S. This study involved the measurement of deposit thickness, an important product characteristic, and was conducted to determine the average thickness of plate necessary to insure that a predetermined percentage of all parts would be plated to a thickness of deposit above the minimum specification.

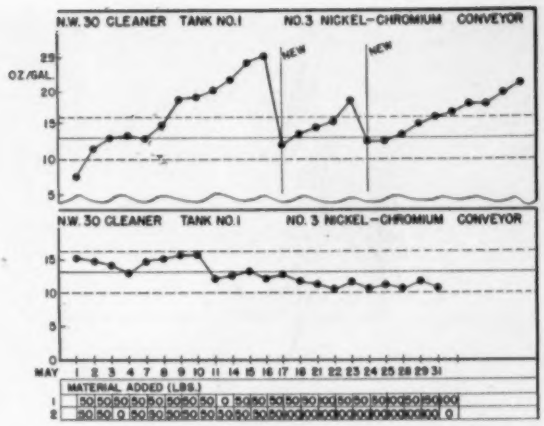


Fig. 1. Portions of two statistical quality control charts recording concentrations of alkali cleaner as well as daily additions to the cleaner tank. On both charts upper and lower limits of solution concentration, as outlined in the process specification, are indicated on the charts by horizontal dash lines. The upper chart shows daily concentrations before statistical quality control was installed in this plating plant. The lower chart shows the record of solution concentrations determined daily after statistical quality control methods were adopted. The conditions shown by the lower chart are much more satisfactory because the cleaner concentration was kept within the specification limits at all times. At the same time a substantial material saving was accomplished (Illustration courtesy Ternstedt Division, General Motors Corporation, Detroit, Mich.)

Statistical Quality Control—Applied

Most electroplaters and chemists working in electroplating plants keep routine records of various chemical constituents or solution variables, such as pH, metallic nickel, boric acid, chloride, free cyanide, copper, chromic acid, sulfate ratio, depending upon the plating solutions used in a particular plant. Briefly, statistical quality control just carries these efforts a step further, and establishes the procedure on a firm scientific basis so that certain control factors may be calculated mathematically, and variations in solution or operating conditions, greater than calculated allowable variations, may be noted and investigated.

Chemical additions made to a cleaning solution or plating bath under statistical quality control may be less or greater than additions made prior to its adoption. If solutions are permitted to deteriorate seriously before additions are made, then material costs under a system of statistical quality control will be less. However, it is more usual to expect solution additions to be slightly greater when operating under statistical quality control, because the solution is kept up to proper operating strength at all times. However, the additions will be uniform, (and will be made more frequently) and each addition generally smaller even though the monthly total may be more.

The important advantage gained through statistical quality control of process variables is not a reduction in material cost, but a greatly lowered unit cost of production made possible by higher current densities, greater hourly production, and less defective work.

How charting the results of regular, daily chemical analyses of plating or other solutions and recording additions made can reduce material costs is shown in Fig. 1. Upper and lower control limits, as established by the process specification, are drawn on the chart, and then the solution concentration, in this case, oz/gal of alkali cleaner, is plotted on the chart each day—the sample of cleaner being taken and analyzed at the same time each day. The pounds of cleaner added each day are entered on another part of the same chart, so that the process supervisor can tell at a glance the solution concentration for any particular day, and the pounds of cleaner added on that day. A record of events or operating conditions which might bear on cleaner operation should be entered on the chart—much as daily events are entered in a ship's log. Average cleaner addition prior to chart control was 183 pounds per day. After chart control was established,

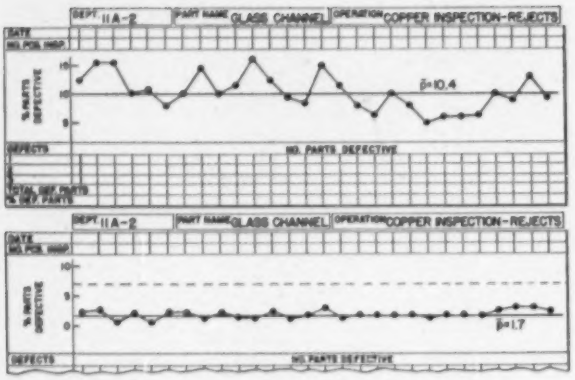


Fig. 2. Portions of charts upon which are plotted the percentage of copper plated parts rejected at the time of inspection. On the same chart the number of parts rejected for certain specific defects may be recorded. The upper chart shows the results of inspection for a three-week period prior to the introduction of statistical quality control to the plating process. As can be noted, the average percentage rejection for that inspection period is 10.4. The lower chart records rejected parts over a similar period of time after statistical quality control was installed. Improvement in quality is indicated by the fact that the average percentage rejected during this period was 1.7. This result was accomplished in the main by improved line inspection procedures and by establishing and maintaining close controls over the copper plating process (Illustration courtesy Ternstedt Division, General Motors Corporation, Detroit, Mich.)

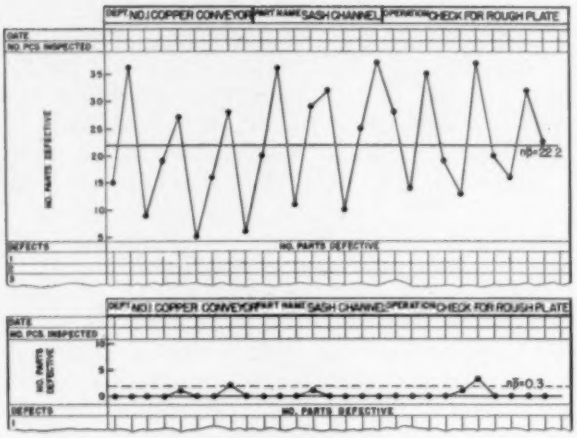


Fig. 3. In the event that one particular defect (as shown by data recorded on charts similar to that shown in Fig. 2) indicates need for corrective action or more thorough investigation, that defect itself may be charted over a reasonable period of time until the defect is minimized or eliminated. In the portions of two charts shown, defects by reason of rough copper plate are recorded. The upper chart, showing conditions prior to the installation of statistical quality control methods, indicates that on the average 22.2 per cent of the parts rejected were rejected because of plate roughness. By closer control of the plating process and by certain adjustments made on the automatic plating equipment the average fraction rejected due to rough plate was reduced to 0.3 (lower chart) (Illustration courtesy Ternstedt Division, General Motors Corporation, Detroit, Mich.)

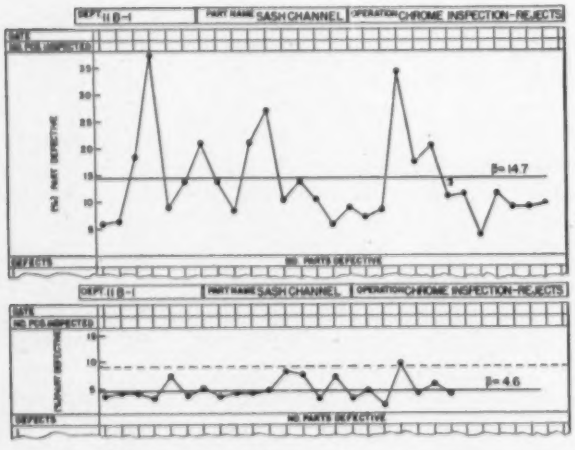


Fig. 4. A comparison of inspection charts showing results of inspection of chromium plated parts prior to and after the installation of statistical quality control methods in the plating operation. The average fraction rejected was reduced from 14.7 to 4.6. Also, as can be noted, the variation in the rejection percentage from the average has been greatly reduced. Improved fabrication and line inspection methods, as well as closer control of plating process, are credited with this improvement. (Illustration courtesy Ternstedt Division, General Motors Corporation, Detroit, Mich.)

the average addition was 125 pounds per day, a 31 per cent saving.

The problem of inspecting the thousands of small parts or products that can be produced hourly from the larger automatic plating installations is no small one. While it may appear desirable to examine each part visually to be certain appearance standards are met, it is an almost impossible task to determine plating thickness, for example, on each part. Sampling inspection procedures may be employed effectively in this and other similar situations. If the per cent of defective or sub-standard items is below a certain value, then the lot is accepted. If the per cent defective exceeds the control limit, then every part in that particular lot is inspected. The saving in time made possible by sampling inspection is evident, both in the actual time required to perform the inspection, and in the elapsed time required for a certain number of parts to pass through this stage of the manufacturing process.

The effectiveness of statistical quality control procedures applied to plating processes in reducing rejects can be determined through inspection charts. The chart used to apply statistical quality control to in-process or final inspection of polished or plated parts or products is the $\bar{p}$ type of control chart, where p is the fraction defective of parts from any one lot, and $\bar{p}$ is the average fraction defective from the entire

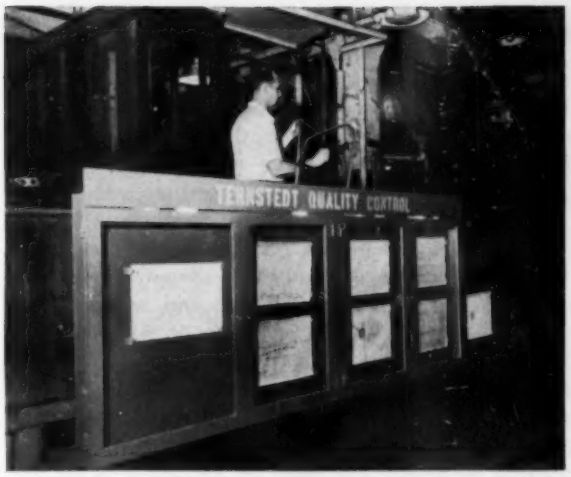


Fig. 5. Statistical quality control, to be completely effective, must keep supervisors and operators alike informed of the status of the various operations with which they are concerned. How this result is accomplished at Ternstedt Division, General Motors Corporation, is shown dramatically in this photograph. All the various charts applicable to the plating or inspection operations in a certain plant area are posted on bulletin boards readily accessible to all personnel concerned. Unsatisfactory conditions as well as improved conditions are immediately obvious. Thus, all can cooperate to eliminate unsatisfactory conditions and in the same way, all can feel a sense of pride and of accomplishment when the charts indicate improvement in quality (Illustration courtesy Ternstedt Division, General Motors Corporation, Detroit, Mich.)

inspection. Data concerning the lot number, sample size (n), number of defective parts (pn), and fraction defective (p), are listed in table form. The average fraction defective ($\bar{p}$) is calculated, and, again using standard mathematical formulas, the upper and lower control limits (UCL and LCL) may be calculated if desired. This information is plotted in chart form as illustrated in Figs. 2 through 4. Lots of parts, used as a basis for these data, have been inspected, presumably, by standard sampling methods to determine the fraction defective. Those lots with a fraction defective falling outside the control limits on the chart, can be set aside for 100 per cent inspection. When the fraction defective falls below the lower control limit an even more careful process investigation is made to determine what was responsible for the excellent results obtained. As the entire operation is brought under statistical quality control, however, the number of lots which require 100 per cent inspection will be greatly reduced, and, as shown on Figs. 2, 3, and 4, the average fraction defective is reduced. At the same time, the upper control limits are lowered. This results in proved, incontestable, increased quality at lowered production cost (material and time).

Fig. 2 is a comparison of copper plated and buffed parts rejected before quality control was installed, and afterward. The average fraction defective ($\bar{p}$) was reduced from approximately 10 to about 1.6 per cent. The number of rejects from any one cause, such as rough plate, can be examined in the same fashion, and Fig. 3 shows how $\bar{p}$ for that defect was reduced from 22 to 0.3 per cent after statistical quality control methods were applied to the plating and polishing operation. A further proof of improvement at a point in the process where improvement is most noticeable can be seen in Fig. 4. These charts show that $\bar{p}$, the average percentage of chromium plated parts rejected, was reduced from 14.7 to 4.6 per cent total rejects from all causes. Causes of rejects are listed on the same chart, to aid the process engineer in his continual fight to improve the process.

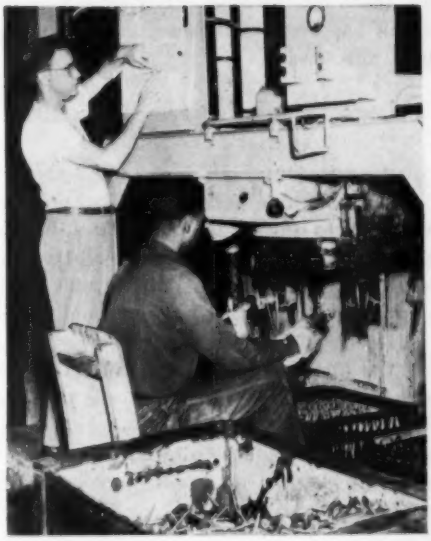


Fig. 6. In one plating plant of the International Harvester Company cotton picker spindles are chromium plated on an automatic conveyor. One hundred samples are inspected from each hour's production and the total number of rejects is recorded on the statistical quality control chart shown at the left in this photograph. As in the case of the charts illustrated in Figs. 2, 3, and 4, rejected parts are listed by cause at the bottom of the same chart so that an excessive number of rejects for any one particular cause may be investigated immediately and the unsatisfactory condition corrected. If the percentage of rejected parts is greater than 2 per cent for each hour's production, then a 100 per cent inspection of that hour's production is made. Normally the average number of rejects experienced is approximately 0.25 per cent, substantially below the upper control limit and far below the figure recorded prior to the installation of statistical quality control methods in this plating plant This control chart is posted immediately adjacent to the unloading end of the chromium plating machine and the inspection station so that inspectors, operators, and supervisors are made immediately aware of unsatisfactory conditions in the plating operation (Illustration courtesy International Harvester Company, Evansville Works, Evansville, Ind.)

"Selling" Statistical Quality Control

The benefits resulting from the adoption of quality control procedures cannot be secured merely by training the plater, chemist, or process engineer in the use of the various charts, mathematical formulas, and procedures, and purchasing the required quantities of paper and ink with which to make the charts. It is necessary not only to train key individuals in the use of quality control procedures, but even more important, it is essential to interest all individuals concerned in the value of quality control, and create a desire on each person's part to cooperate in making the project a success. Hence, a thorough educational program must be initiated. Each employee in the plating or polishing department must be made conscious of this new way of measuring results from a production operation, and must be awakened to its importance and value to him. Only after this spirit of cooperation has been established, can the system become truly effective.

Intangible Benefits from Statistical Quality Control

As can be noted in Figs. 5 and 6, quality control charts are posted in a conspicuous location immediately adjacent to the plating operation, or point of inspection, so that the operators and supervisors alike can see improvements in quality as reflected in the various charts. They are thus continually reminded of the value of statistical quality control. Such a program has the further value of dramatizing the position and importance of many employees, who might previously have had the feeling that they were merely parts of a production machine. As everyone knows, an interested employee, and an employee who is made to see and feel his importance, is a much more valuable employee.

Perhaps the improvement in production resulting from improved employee morale—particularly in the larger plating shops—is even greater than that resulting from material and time saving made possible through statistical quality control. In any case, all these benefits are being obtained in the plants where statistical quality control has been properly installed, and is being used properly.

Acknowledgment

The author wishes to express his deep appreciation to Bryant W. Pocock and Frank L. Bonem, consulting and contributing editors of "Products Finishing", for their assistance in assembling the material on which this paper is based.

REFERENCES

[1]S. B. Littauer, "The Development of Statistical Quality Control in the United States", published in the December, 1950 and the February, 1951 issues of The American Statistician.

[2]W. A. Shewhart, "Economic Control of Quality of Manufactured Product", D. Van Nostrand & Co., Inc., 250 Fourth Avenue, New York, N. Y., 1931. "Statistical Method from the Viewpoint of Quality Control", (Edited by W. Edwards Deming) The Graduate School, Department of Agriculture, Washington, D. C., 1939.

[3]H. F. Dodge and H. G. Romig, "Sampling Inspection Tables —Single and Double Sampling Tables", John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1944.

[4]"A. S. T. M. Manual on Presentation of Data", American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

[5]L. E. Simon, "An Engineer's Manual of Statistical Methods", John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1941.

[6]W. C. Geissman and R. A. Carlson, "Current Distribution in Barrel Plating", Proc. Am. Electroplaters' Soc. 39, 163–165 (1952).

[7]E. L. Grant, "Statistical Quality Control", McGraw-Hill Publishing Co., Inc., 330 W. 42nd Street, New York, N. Y., 1946.

[8]A. V. Feigenbaum, "Quality Control—Principles, Practice, and Administration", McGraw-Hill Publishing Co., Inc., 330 W. 42nd Street, New York, N. Y., 1951.

[9]E. M. Schrock, "Quality Control and Statistical Methods", Reinhold Publishing Co., 330 W. 42nd Street, New York, N. Y., 1950.

[10]N. L. Enrick, "Quality Control—Manual of Practical Procedure for Shop and Plant Operation", The Industrial Press, 148 Lafayette Street, New York, N. Y., 1948.

DISCUSSION

Mr. H. A. Fudeman (Trico Products Corporation, Buffalo, N. Y.): Unfortunately, plating inspection still relies on the human eye. Do you know of any devices in use that would replace this method?

Mr. Blount: There are some devices in use which measure appearance characteristics, depending upon the properties that you wish to inspect for, but generally in inspecting for appearance, the human eye is still the fallible though useful tool.

Dr. A. M. Max (RCA Victor, Indianapolis, Ind.): I would like to make a comment that physical inspection does not reduce rejects. Statistical quality control is simply a tool to assist in product control and remove the causes for rejects.

Mr. Blount: Thank you very much, Dr. Max. Yes, I am familiar with the fact that you cannot inspect quality into the product, you have to build it in.

Mr. William Geissman (National Lock Company, Rockford, Ill.): I certainly want to again impress upon you the statement the author made when he said that you have to begin at the beginning. You must obtain the whole-hearted cooperation of your entire plant in order to use this tool called Quality Control. In other words, one cannot expect you to put on a specified plate thickness of, for instance, 2 ten-thousandths of an inch and then have the part which came to you undersize by much more than that and then build it up to the proper size. Neither can you plate parts that are oversize before plating and expect them to be within tolerance after plating. These parts should have been rejected before plating. Nor can you level out gross polishing marks or tool marks and expect to get a good looking part. Here again rejection before plating is a must.

I also have a question for the author. Are any companies using statistical methods to evaluate the appearance of plated ware for decorative purposes? We know these methods are being used in the paper indus-

try and the leather industry, but as yet we have not found anybody using it in the plating industry. We are trying to work out a method ourselves, but it is a long, hard row.

MR. BLOUNT: I don't know anything about the evaluation of appearance in the plating industry, either, Mr. Geissman. You are probably familiar with the work being done in the porcelain enamel industry along that line; they have evaluated various surface defects. If you study that perhaps you can borrow some ideas from another industry.

MR. FRANK TIRENDI (Patent Button Company, Waterbury, Conn.): How is the upper and lower control limit determined for a given process?

MR. BLOUNT: In two ways—one by the process specification which the plating solution supplier or your own process engineer establishes; the other, by means of the statistical control method. Upper and lower control limits are calculated by two relatively simple formulas which I did not go into because I wanted to keep mathematics out of the discussion. They are discussed in the A.S.T.M. Manual on "Quality Control of Materials".

MR. THOMAS J. MENZEL (Jack Steele Company, Philadelphia, Pa.): It is true, Mr. Blount, that analysis is of prime importance. However, I do want to suggest that analysis complemented by plating tests is true control.

MR. BLOUNT: Thank you, Mr. Menzel.

MR. WILLIAM E. TREMBLEY (Texas Instruments, Inc., Dallas, Texas): By statistical control do you mean the installation or use of in-process inspection to a greater degree than say we have it at present?

MR. BLOUNT: That is correct. It is not only in-process inspection, but control of the product all the way through the process. The application of these charts and methods carries process inspection one step farther.

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First Women Delegates at Philadelphia

The Fortieth Annual Convention held at the Benjamin Franklin Hotel in Philadelphia saw the establishment of another "first" in the long history of the Society. The event that put the pen of the historian to work was the presence of two women delegates at the business sessions: Mrs. Julia Madzik of the Hartford Branch and Miss Edna Rohrabaugh of the Indianapolis Branch.

Madzik

It was during the world struggle of the 1940's that Mrs. Madzik took the step that led her to her ultimate association with the A. E. S. She began her employment with the Connecticut Telephone and Electric Company in Meriden where her duties as a laboratory assistant sparked further interest in metal finishing operations. Her ability in the field led to recognition by her employers in the form of promotions so that she is now in charge of their chemical laboratory.

Julie, as she is usually called, became a member of the Hartford Branch in May, 1947 and was elected to serve on the Educational Committee of the Branch for the 1950–1951 term and again for another term from 1951–1952. She was elected to the office of Branch First Vice-President for the 1952–1953 year and will serve as President of the Hartford Branch for the current term, 1953–1954.

As far as is known, Mrs. Madzik is the first woman to hold this high office.

Julie has served as technical chairman on several occasions and has been of tremendous help whenever her Branch has held a Ladies' Night affair.

She attended Hillyer Junior College in Hartford, is married and has one daughter.

Miss Rohrabaugh began her association in the plating industry when she started working for the Lafayette Plating and Enameling Company, Lafayette, Ind., in February, 1930 after her graduation from high school and upon the completion of a five-months' business college course.

Rohrabaugh

Her initial job with the company as a bookkeeper and stenographer exposed her to the many fascinations of the plating business. Her thirst for more information of the game led her to learn more and more of its numerous technical and practical phases. Since her employer's plant was a general job shop, she had every opportunity to learn much about the art. Following the death of the owner about five years ago, Miss Rohrabaugh was asked to manage the business. During those five years she has added to her lore of job shop operations, but still feels that something new can be learned in the plating business every day.

She has been active in the affairs of the Indianapolis Branch and is again serving another term as secretary of that group. She states that she is proud at having been chosen for that office and feels that there is a place for women in the plating field.

A CORROSION STUDY OF VARIOUS CHROMIUM PLATED ELECTRODEPOSITS*

H. BROWN† AND E. W. HOOVER‡

Abstract

Corrosion results in salt-spray, humidity, and outdoor exposure tests are presented for various coatings which are cathodic to steel. These include nickel, nickel-cobalt, nickel-iron, copper, chromium, gold, and rhodium in various combinations.

The role of inherent porosity and electrochemically induced porosity is discussed for the various deposits in various combinations in the different environments.

An interesting finding is detailed on the use of a thin rhodium plate between nickel plate and the final thin chromium plate that resulted in excellent protection of steel and other metals when exposed to an industrial atmosphere. Another finding outlined is that of 0.2 to 0.6 mil thick bright nickel-iron alloy plate (80–20) with a final thin chromium plate which protected brass in salt-spray and outdoor exposure tests equally as well as nickel plate of the same thickness and with the same final thin chromium deposit. This was found not to hold true for thicker nickel-iron deposits with subsequent chromium plate on steel.

Introduction

Even if it is assumed that there are adequate amounts of nickel for bright plating, the problem of obtaining satisfactory outdoor service-life for bright plate with a final chromium deposit still has many interesting facets despite the great volume of work that has been done on this subject[1].

The tests outlined below were started[2] in 1946, because of the disparity between results of salt-spray and outdoor exposure tests for copper-nickel-chromium coatings. The study was oriented toward obtaining a better understanding of the mechanism of failure of these coatings which are cathodic to steel, and to evaluate more clearly in this connection the respective roles of the inherent porosity of the coatings involved, and the electrochemically induced porosity in the coatings.

Corrosion results in salt-spray, humidity, and outdoor exposure tests in the industrial atmosphere of Detroit were obtained for several important electrodeposited coatings which are cathodic to steel, namely: nickel, nickel-cobalt alloy (approx. 80–20), nickel-iron alloy (approx. 80–20), and copper; first as foils, with and without a final chromium plate, and then when these same coatings were electrodeposited in various combinations on various basis metals. Rhodium and gold plate were also studied with and without a final chromium plate. Over 100 foils, over 300 plated panels (3 x 8 and 6 x 4 inch steel and brass panels) and over 100 plated bumper-guards were studied. The corrosion results obtained clearly showed in which cases inherent porosity is the main factor in lack of protection for a given plate or combination of plates on a given basis metal in a given environment, and in which cases electrochemically induced porosity is the dominant factor.

An interesting finding from these studies was that the use of a thin rhodium plate between the nickel and the final thin chromium plate resulted in rather amazing outdoor protection of steel, even though thin chromium and rhodium plates by themselves showed great inherent porosity and stress-cracks.

The inherent or intrinsic porosity of thin electrodeposits is one of the major problems in electrodeposition, and is bound up with such fundamental problems as the mechanism of crystal growth in electrodeposition processes, and the question of the mosaic structure of crystals as considered by Smekal, Darwin and others[3].

With a millionth of an inch of plate or less, there is practically "infinite" porosity, and with increasing thickness of plate, the porosity becomes more intricate and decreases rapidly according to some function of the thickness, the nature of the metal being deposited and the nature of the plating bath.

It is often mentioned in the literature, especially with respect to nickel plate on steel, that a major goal is to obtain pore-free thin deposits. It is not,

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*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 15, 1953.

†Research Director, Udylite Corporation, Detroit, Mich.

‡Metallurgist, Udylite Corporation, Detroit, Mich.

however, the inherent porosity of coatings of 0.2 to 0.5 mil thick nickel that is the key factor in outdoor exposure failure of copper-nickel-chromium coatings. It is, instead, the galvanically induced porosity occurring through the inherent porosity in the thin final chromium deposits and through the stress-cracks of thicker chromium deposits that is most decisive in corrosion failure in outdoor industrial atmospheres. Industrial atmospheres differ from rural ones in the content, among other things, of soot, sulfurous and sulfuric acid, mainly from the burning of coal*. However, in the neutral salt-spray test neither the inherent porosity nor the presence of stress-cracks in the final chromium plate is the decisive factor in corrosion failure of chromium over nickel plate†. This is the main reason for the great disparity between salt-spray test and outdoor exposure results for chromium over nickel. This will be made abundantly clear from the corrosion data given below for exposure to salt-spray, humidity, and industrial atmosphere tests.

Salt-Spray and Humidity Test Results

It is well established that the salt-spray test does not serve as a satisfactory accelerated trial method for use in predicting outdoor exposure results with copper-nickel-chromium plate. This has recently been exhaustively and brilliantly reviewed by LaQue[5] and others. It is a common experience to find thin nickel plate of 0.1 mil with 0.01 to 0.02 mil of chromium on a good grade of cold-rolled steel to give as good salt-spray test results at the end of 24 or 48 hours as nickel ten times as thick with the thin chromium plate. This is never true for outdoor exposure, and always the thicker nickel plate gives the superior results. In fact, the nickel plate of 1 mil thickness can be safely said to give about fifty times the protection of the 0.1 mil plate; that is, with increasing nickel thickness above about 0.7 mil the improvement in corrosion protection increases geometrically‡, if the final chromium plate is of the same thickness. If the final chromium plate over nickel is omitted, then there is much better correlation between results of salt-spray and outdoor exposure tests, and the thickness of nickel is the prime factor in the salt-spray test as well. However, the use of nickel without the final chromium deposit in the testing is not exactly pertinent even though instructive.

The reason that the salt-spray test results for copper-nickel-chromium differ from those obtained in outdoor industrial atmosphere is, of course, related to the fact that the media of the former method is a neutral though highly concentrated electrolyte, whereas condensed moisture of the industrial atmosphere is a very weakly acidic electrolyte. Thus, exposure of such

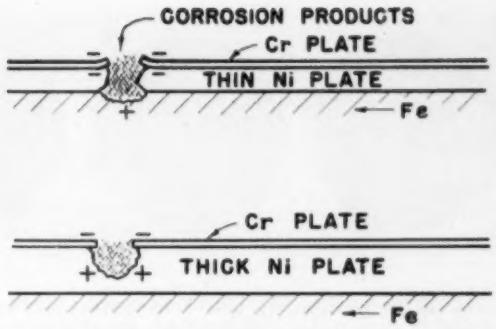

Fig. 1. Top section of drawing illustrates galvanic corrosion of thin plate by an industrial atmosphere. Bottom section shows the geometrically increased protection to the basis metal afforded by thick nickel plate.

deposits over the moist vapor of readily volatile acids, for example, nitric acid[6] will show in a very short time (1–24 hours depending on the temperature and concentration of the acid), the initial points of corrosion attack similar to those which occur in 1 to 3 years' outdoor exposure in an industrial atmosphere.

In actual service conditions of copper-nickel-chromium plated parts on automobiles, the concentration of electrolyte in outdoor exposure may at times be high, as during the winter months in certain areas when salt is thrown on the streets to melt snow and ice. Under these conditions the failure of chromium plated nickel deposits up to about 0.7 mil thick on steel is much more rapid than would be predicted from salt-spray test results. This is because of the combined effect of the traces of acid in the industrial atmosphere along with the high concentration of salt solution from the streets. The salt greatly accelerates the effect of the traces of acids coming from the industrial atmosphere by the way of exhaust gases, burning of coal, etc. The presence of the high concentration of electrolyte on the porous or stress-cracked chromium surface leads to the unfavorable condition of large cathodes (the chromium surface) and small anodes (the exposed underlying metal at the pores and cracks of the chromium plate), and intense rapid pitting of thin nickel plate is then favored. This is similar to the unfavorable condition of using steel rivets in large sheets of monel in sea water exposure.

Examination of the results obtained with electrodeposited foils of these metals is instructive in promoting the better understanding of the various electrochemical processes that may be involved in the failure of cathodic coatings.

Salt-Spray Test Results with Foils

Nickel foils plated from various baths were studied:

*For example, in London it has been calculated that at least 1,000 tons of sulfuric acid goes into the air in a day[4], though it rains so frequently in London, the corrosion effects from the acids are less than one might expect.

†These defects are, however, important for chromium directly over copper, brass or zinc in the salt-spray test.

‡Due to the widening of the corrosion pit at the top and narrowing at the bottom as corrosion proceeds (See Fig. 1).

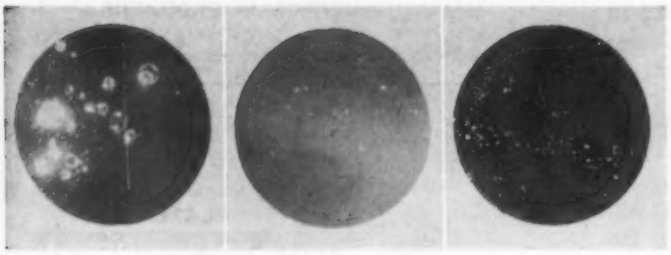

Fig. 2. Shadowgraphs showing perforation of Watts' dull nickel foils after 200 hour exposure in a salt spray test. (a) Highly perforated condition of thin Watts' dull-nickel foil. (b) Smaller perforation of thick Watts' dull-nickel foil. (c) Localized perforation of a dull-nickel foil caused by entrapment of solution and exclusion of oxygen under a nylon string

Watts' baths purified by activated carbon treatment and low current density electrolysis, all-chloride baths, semi-bright plating baths giving deposits containing approximately 0.02 to 0.1 per cent carbon, full-bright nickel baths giving deposits containing about 0.02 to 0.08 per cent sulfur (as sulfide) and approximately similar percentages of carbon. Also studied were wrought nickel sheet, nickel deposited from a purified Watts' bath and hydrogen-annealed at 1200° to 1400° F, copper foils from copper sulfate baths, and nickel-cobalt and nickel-iron alloys from Watts' type, chloride, and fluoborate baths and mixtures.

The foils were prepared by plating on nickel surfaces sufficiently passivated to obtain deposits which were non-adherent but not blistered.

All of these foils suffered localized or pitted attack and perforated[7] rather rapidly if thin (0.2 to 0.5 mil). The thin foils, of course, perforated much more rapidly than thicker ones, and became like screens in about 100 to 200 hours in the salt-spray test, and because in this perforated condition they hold more salt droplets, they tended to show more weight loss after the basic salts were removed than thicker foils having the same surface areas. (See shadowgraphs of foils, Fig. 2.)

The loss of weight of the foils and the number of perforations obtained in the tests varied with the temperature, *p*H, and the number and size of the droplets of salt solution that condensed or fell on the surface. The latter depends among other things on the degree of cleanliness, and on the wettability of the foils, which, in turn, depends on the nature of the metal, its grain size, flatness and angle of exposure. Since the number and size of drops that condense vary with different foils, the problem of getting accurate quantitative data must necessarily take into account statistical methods, unless definite size salt drops are deposited for study.

With foils of 1 to 2 mils thickness the loss of weight in 100 hours in the salt-spray test was only about 1 to 3 mg/dm^2 or on an area of one square foot (9.3 dm^2) it would represent a loss of 9 to 28 mg of nickel. Since this loss of weight in the salt-spray does not represent uniform corrosion, but instead a highly localized corrosion of the severe pitted type, it is very serious with foils 0.2 to 0.5 mil thick. There may be as many as 500 holes or more per square foot with the thinner foils (Fig. 2). Thick deposits (5–20 mils) should be used to avoid perforation which might introduce error in comparison tests of weight losses.

Copper foils like nickel foils also perforated in the test and at fairly similar rates. When copper foils were marked with graphite (pencil) the marked part corroded through before the rest of the foil perforated. Rubbing the foil with a glass rod did not accelerate perforation. Nickel was not as critical to a carbon mark or coating as was copper. This is because the potentials of nickel and carbon are much closer together than copper and carbon in the salt-spray media. Also, when copper about 0.1 mil thick was plated on nickel foil and exposed in the salt-spray, the copper dissolved away, that is, it was attacked preferentially to nickel since copper in the presence of oxygen saturated neutral salt solution is anodic with respect to nickel.

Nickel-cobalt alloy foils behaved like nickel foils in the salt-spray test. Nickel-iron alloy foils (80–20 approximately) showed rust spots in about six hours, but it usually did not perforate as rapidly as nickel or nickel-cobalt foils. This does not necessarily mean that the rate of attack on the nickel-iron alloy was less, but that the pitting was of the more shallow type. Thin hydrogen-annealed nickel foils perforated about as rapidly as unannealed foils.

The perforation of thin foils of nickel, nickel-cobalt, nickel-iron and copper appeared to depend largely on the "differential aeration" or oxygen cell effect described by U. R. Evans[8]. The center of the drop tends to become anodic and the area around the edge and underneath the meniscus of the drop where the oxygen concentration is kept at a maximum by contact with the surrounding air, tends to become cathodic. With nickel foil the center of the drop started turning green showing the anodic attack on the nickel. Eventually basic nickel salts precipitated between the anodic center of attack and the cathode (Fig. 3). As the basic salts precipitated the points of anodic attack probably shifted to points under the spongy precipitate thus causing clusters of tiny perforations because there was less oxygen there. In Fig 2c the string of tiny perforations which occurred under a nylon thread are also due to the lack of oxygen there compared to the surrounding area.

Salt-Spray and Humidity Test Results with Plated Panels

The steel panels used were No. 3 bright finish, cold-rolled low carbon steel. Most of the tests with this steel were run without polishing the steel. The bumper-

guards were hot-rolled steel and were commercially polished with 180 Turkish emery with grease.

With 1.0 to 1.5 mil thick nickel or nickel-cobalt plate on steel and without a final chromium plate the number of rust spots at the end of 24 to 48 hours in the salt-spray averaged only about 20 per square foot. Even at the end of 400 hours or more with such thicknesses there were no further rust spots, which indicated, of course, no further perforation, whereas, with foils of the same thickness, hundreds of perforations occurred on the same area. That is, the number of pores or perforations obtained on plated panels was far less than with similar thicknesses of nickel or nickel-cobalt foils similarly exposed. The reason for this difference is apparently the following: Once a corrosion-pit reached the underlying more readily attacked base metal, the latter corroded preferentially and more intensely and also because of the high concentration of electrolyte cathodically protected an appreciable area in the neighborhood of the corroding pit. In fact, sufficient alkali may have been produced in the cathodically protected area so that it spread out more generally over the surface and helped protect the nickel from further attack. With nickel plate less than 0.1 mil thick and without a final chromium plate, the perforation of the nickel was so rapid that rust spots appeared almost simultaneously over the entire surface before any significant cathodic area of protection of the nickel could start.

In 100 per cent humidity at 100° F the nickel-iron (80–20) alloy plate itself showed no rusting at the end of 1,000 hours and protected steel equally as well as nickel or nickel-cobalt plate of the same thickness in this environment. That is, from 0 to about 20 rust spots per square foot were obtained on smooth or well polished steel surfaces with the rust coming from the basis metal. The failure at these spots, the authors believe, was mainly because of certain basis metal defects such as slag or insulating spots on the surface which were not completely plated over, or to possible inclusion in the plate of some floating particles such as carbon, precipitated hydroxides and carbonates ("roughness" particles), from the bath during plating. When panels were plated in an inclined position in a filtered and settled bath to avoid any settling of particles on the surface, there were usually fewer rust spots but some occurred and these were probably due to basis metal defects.

This type of porosity is best called "accidental" porosity as defined by Thon and co-workers[9], and is not very accurately predictable by observation of a given steel surface and the final plate. The fact that nickel, dull or bright, nickel-cobalt, or nickel-iron deposits of about 0.1 mil thick gave good protection to steel in humidity chamber tests, indicated that the inherent porosity of these coatings was negligible as far as moisture was concerned. Chromium plate of 0.01 to 0.1 mil thickness direct to steel, unlike the nickel and the high nickel alloy plate, did not protect steel in a humidity cabinet and in about 100 hours or less,

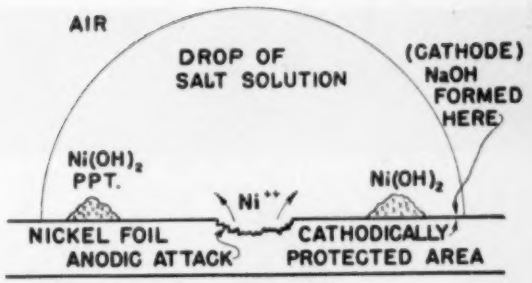

Fig. 3. Drawing shows the differential aeration corrosion cell described by U. R. Evans which prevails under a drop of neutral salt solution on nickel foil

practically the entire surface of the chromium was covered with heavy rust incrustation. This was due to the inherent porosity of chromium deposits, 0.01 to about 0.04 mils thick and to stress cracks in the thicker chromium deposits.

Thin chromium deposits direct on steel failed rapidly in both the salt-spray and humidity tests, and in 24 hours about a thousand rust spots per square foot were present. When nickel or nickel-cobalt plate about 0.1 mil thick was electrodeposited directly on steel and exposed in the salt-spray in contrast to the humidity results, about a thousand rust spots per square foot appeared in about 24 hours. This failure was predominantly due to the electrochemically induced porosity of the differential aeration type as already described with the foils (Fig. 3), and not to inherent porosity or stress-cracking. When the same thin nickel, or nickel-cobalt, or nickel-iron plate was given a final chromium plate of about 0.01 mil thickness then only from 0 to about 20 rust spots per square foot were obtained in 24 hours' exposure in the salt-spray test, but unfortunately the same remarkable protection did not occur in outdoor exposure.

Unlike the nickel, nickel-cobalt, nickel-iron and copper foils, chromium plate showed no attack or loss of weight in the salt-spray test at the end of over 400 hours. There were some instances of a slight green stain when the chromium was suspended by a tightly pressing nylon string, but this was due to the absence of oxygen underneath the string or holder, indicating the consequent loss of passivity and the beginning of attack of the chromium at that point or edge.

Chromium plate apparently needs only a small amount of oxygen in neutral salt solution to keep it quite passive. Apparently the difference in concentration of oxygen at the center of a drop and at the periphery is too small to be significant in setting up a differential aeration cell. This is in contrast to nickel, as well as chromium under a tight nylon string or other air-excluding cover.

The fact that exposed chromium plate is not discernibly attacked by salt droplets, still doesn't explain the remarkable protection it afforded nickel and high nickel-alloy plate including nickel-iron (80–20)

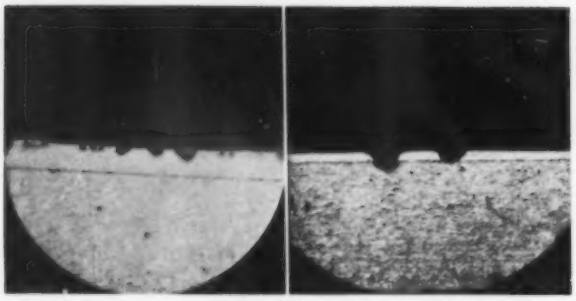

Fig. 4. (a) shows the results of industrial atmospheric attack of nickel plate exposed through the pores and cracks of thick chromium plate. (100X) Nickel 0.0015 inch thick under 0.00008 inch chromium on low carbon steel panel that was exposed outdoors five years. (b) shows the results of industrial atmospheric attack of nickel plate exposed through pores and cracks of thin chromium plate. Note that the plated deposit is not lifted. (45X) The nickel is 0.0015 inch thick under 0.00002 inch chromium on low carbon steel that was exposed outdoors six years

in the salt-spray test. Chromium plate has defects of inherent porosity when very thin and stress-cracks when thicker, yet chromium plated nickel foil showed no attack or loss of weight in the salt-spray test. Evidently the nickel or high nickel alloy plate is made very passive by contact with the chromic acid bath during chromium plating. Actually the simple steps of just dipping nickel for a few minutes in chromic acid plating baths and then allowing a faint film of chromic acid or chromates to remain on the nickel after rinsing and drying remarkably inhibited the rate of attack and perforation of nickel foil in the salt-spray test. Apparently, for this reason, the nickel exposed under the pores and stress-cracks of the chromium plate was not very susceptible to the differential aeration cell attack which operated so destructively on nickel or nickel alloy foils. It was also apparent that there was practically no galvanic attack on the nickel exposed through the pores and cracks of the chromium plate. The potential of passive nickel and especially that with a trace of a chromate film on it was very close to that of chromium in neutral salt solution, as indicated by the galvanic series obtained with sea water.

In the salt-spray test the high concentration of chloride ions, even though in neutral solution, decreased the passivity of chromium to a certain extent, bringing it closer to the potential of passive nickel. However, in outdoor industrial atmospheres, the presence of traces of sulfur acids in the moisture or dew condensation was insufficient to decrease the passivity of chromium appreciably and the chromium acted more noble or cathodic in outdoor exposure with respect to the nickel exposed through the pores or cracks of the chromium plate (Fig. 4).

It is of instructive value to note that, when the noble metal rhodium was used instead of chromium as a final thin coating over nickel, rhodium was more noble than nickel and acted very cathodic to it both in the salt-spray test and outdoors, and here, salt-spray test results check very well with those obtained in outdoor exposure experiments.

Rhodium, like chromium, was not attacked in salt-spray tests and like chromium deposits 0.02 to 0.10 mil thick those of rhodium were subject to stress cracking. In the following tests rhodium was plated from the acidic sulfate bath as described by H. Wiesner[10]. Thus, when 0.01 to 0.1 mil rhodium was plated over 1 mil thick nickel plate on steel there was rapid failure under outdoor exposure conditions as well as in salt-spray tests. That is, rhodium, unlike chromium from the chromic acid bath, did not protect nickel in the salt-spray test but actually greatly accelerated the attack of the nickel exposed through the pores and stress-cracks in the rhodium plate and a great deal of rust from the plated steel panels appeared in 24 hours in the test.

When steel was plated with a composite coating consisting of nickel about 1 mil thick, rhodium 0.01 to about 0.06 mil thick and finally with 0.01 to 0.02 mil thick of chromium plate from the chromic acid bath then rather amazing protection was obtained in both salt-spray and outdoor exposure tests. The potentials of passive chromium and rhodium are evidently quite close together, and the rhodium exposed through the pores of the chromium plate, therefore, did not become anodic. Also the type of pores and cracks in the rhodium plate may have been conducive for adsorption and for chromium to cover, or to deposit therein basic chromates or chromic salts. Higher potentials were needed for depositing chromium over rhodium than over nickel.

With gold, 0.01 to 0.05 mil thick, plated from a cyanide bath over nickel plate, rapid failure was experienced in outdoor industrial atmosphere and salt-spray tests. With gold plate 0.1 mil thick and higher, the number of pores in the gold plate was greatly decreased and much better protection to nickel plated steel in these tests was obtained. Gold plate, unlike the harder rhodium plate, did not stress-crack. When gold was substituted for rhodium between chromium and nickel the tendency for improved results was the same but to a lesser extent. In air, gold did not appear to be quite as noble as chromium. These results with gold, rhodium and chromium as composite plates, as well as silver, palladium and platinum over various metals will be reported in another paper (H. Brown and J. Manquen).

Outdoor Exposure Test Results

Nickel-cobalt and nickel-iron (approximately 80–20) alloy deposits of 1 to 1.5 mils thickness without a final chromium plate protected steel much better in an industrial atmosphere[11] than nickel plate of the same thickness. The salt-spray test did not indicate this great difference. At the end of 5 years' outdoor ex-

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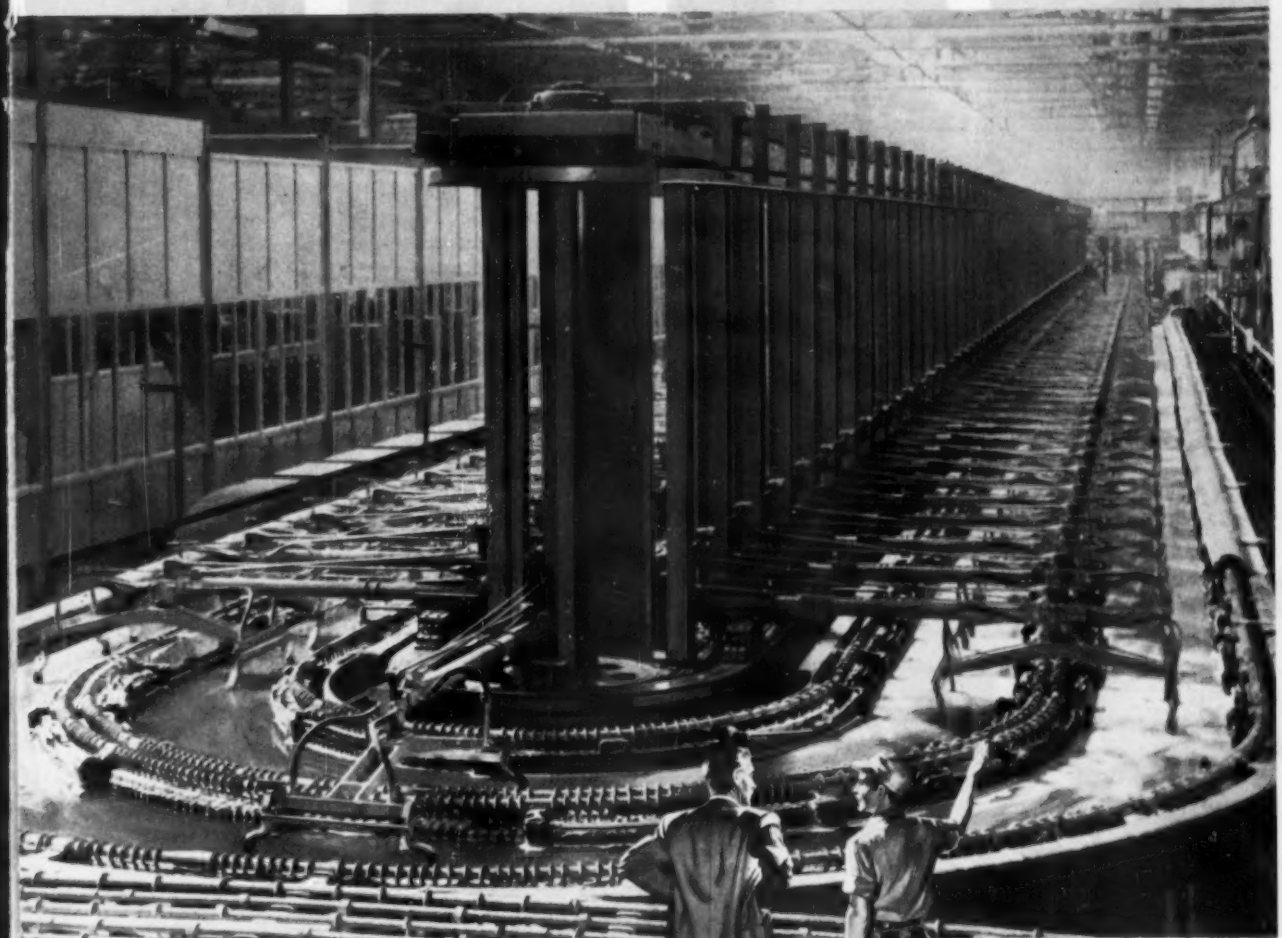

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posure, the nickel plated steel had about 50 to 100 rust spots per square foot. On the other hand, the nickel-cobalt alloy plate had a flat and quite even film of yellowish-green colored corrosion products. The nickel-iron alloy plate had a similarly flat and quite even film of brownish-yellow corrosion products with no attack of the base metal. In the latter two instances maximum penetration only about half way through the plate was in evidence. The nickel-cobalt alloy appeared to be somewhat superior to the nickel-iron alloy. The lower susceptibility to deep corrosion pitting by the nickel-iron and nickel-cobalt alloy plate, that is, the tendency instead for more uniform corrosion is doubtless due to (1) the millions of tiny anodes set up by the cobalt and iron atoms with respect to the nickel atoms in the presence of the very weak electrolyte that constitutes the condensation or dew in industrial atmospheric exposures and (2) the structure of the corrosion products. In salt-spray tests in the presence of concentrated salt droplets, the number of anodes forming is much smaller and the cathode area is far greater. This condition of large cathode areas and small anode areas causes localized pitted attack.

However, when the nickel and nickel-cobalt plate of 1 to 2 mils over steel were coated with the same thickness of chromium plate, the difference between nickel and nickel-cobalt plate was eliminated and both gave quite similar corrosion results, and the appearance of the chromium plated work was quite similar at all stages during 5 years' exposure in an industrial atmosphere.

The chromium plated nickel-iron (80–20) deposits of 1 to 1.5 mil thickness on steel, on the other hand looked worse than chromium plated nickel at the end of about 2 months' outdoor exposure in the late fall, winter, or early spring* and remained worse in appearance for at least 5 years (Fig. 5). The salt-spray didn't indicate this.

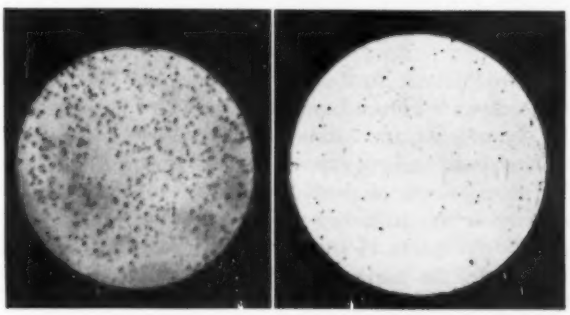

Fig. 5. "Fax-Film" pictures from plated bumper-guards exposed outdoors five years, showing wider corrosion pits on (a) chromium plated nickel-iron alloy plate compared to (b) chromium plated nickel. (3X)

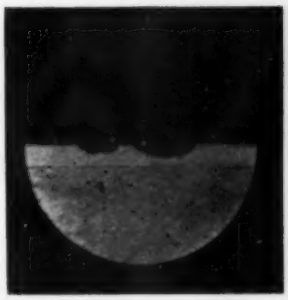

Fig. 6. Wide shallow corrosion pits of chromium plated nickel-iron alloy plate after exposure to industrial atmosphere outdoors for 5 years. (50X) Approximately 0.002 in. nickel-iron alloy plate under 0.00002 in. chromium plate on a low carbon steel bumper guard. Compare with Fig. 8 (b)

This does not mean that the steel wasn't protected as well with the nickel-iron alloy (80–20) as with nickel, but that the corrosion pits in the chromium plated nickel-iron plate were wider with respect to their depth of penetration and darker due to the presence of iron corrosion products from the plate itself (Fig. 6). The average diameter of the corrosion pits after about 4 years' outdoor exposure was approximately 3 to 4 mils, whereas the chromium plated nickel developed pits that had about half this diameter.

When the nickel-iron (80–20) alloy was plated on brass to a thickness of 0.2 to 0.6 mil and given a final thin chromium plate, the outdoor exposure results at all stages during 3 years were the same as for chromium plated nickel of the same thickness on brass. The reason for the difference in results of chromium plated nickel-iron alloy (80–20) on steel and brass where a different thickness of nickel-iron alloy plate is used is made clear in Fig. 7. Perforation of 0.2 to 0.6 mils deposits of nickel or nickel-iron plate on brass, through the pores in a chromium overlay occurred quite rapidly in an industrial atmosphere, and the brass basis metal was reached almost simultaneously, perhaps a little faster with the nickel deposit. Then the corrosion of the brass proceeded preferentially though quite slowly compared to steel, and hence the

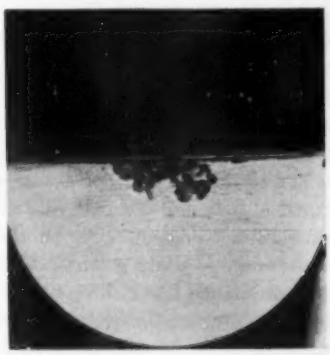

Fig. 7. Approximately 0.0003 in. nickel-iron plate with 0.00002 in. chromium on 70–30 brass. (100X) Etchant: none. Outdoor exposure, four years

*During these seasons much coal is burned and the amount of humidity and dew condensation is high, all of which helps to keep the surface of the plate covered with a stagnant film of moisture containing traces of acid, and the corrosion effects are then more severe than during the rest of the year.

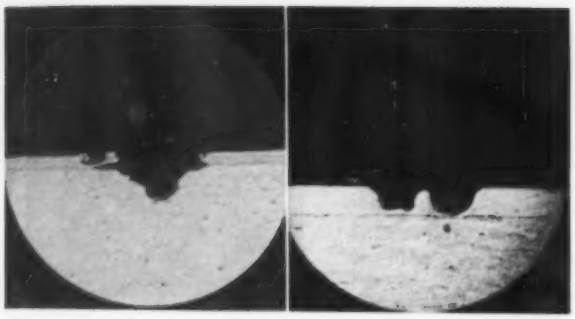

Fig. 8. (a) shows a chromium plated composite plate of 0.0003 inch thick nickel and 0.0008 inch thick copper on a low carbon steel bumper-guard after being exposed outdoors eight months. (100X) (b) shows a nickel plate 0.002 inch thick with 0.00002 inch thick final chromium plate on a low carbon steel bumper-guard after being exposed outdoors five years. This illustrates how the corrosion pits in nickel widen at the top as penetration proceeds toward the basis metal. (100X)

appearance of the plates was always quite similar.

Corrosion protection obtained in an industrial atmosphere with 1 mil thick nickel plate on steel and a final 0.04 to 0.08 mil thick chromium plate was superior[12] to that afforded by the same thickness of nickel with a thinner final chromium plate of 0.01 to about 0.03 mils. In fact, at the end of 6 years' exposure, panels with the thicker chromium plate, while showing the stress-crack pattern of the chromium, showed very little attack of the steel, whereas, with the thinner chromium plate most of the corrosion pits penetrated to the steel. Fig. 4 clearly shows the difference in protection in an industrial atmosphere. The reason the electrochemical corrosion in a pore was more intense than in a crack was due to the smaller anode area in the pore. However, in original appearance, the heavier chromium plate was inferior to the thinner chromium plate with respect to the visibility of the stress-cracks and the brightness of the chromium deposit.

With chromium plated directly on copper, brass or zinc, the salt-spray and outdoor exposure test results correlated quite well. In all these cases the corrosion products of the underlying metals appeared through the pores and cracks of the chromium plate, and undermined the brittle chromium plate tending to flake it off as corrosion proceeded. When such combinations must be used for outdoor exposure service, lacquers or baked clear enamels must be relied on for additional protection. Protection is afforded if good adherence of the organic coating is obtained, even if the lacquer or clear enamel has quite a number of pores. This was shown by testing lacquer or clear enamel coatings directly on steel in salt-spray tests. The non-conducting film eliminated the large cathode areas, leaving only negligible tiny cathode and anode areas exposed in the pores of the insulating film. However, an interesting phenomenon was found to occur in the salt-spray testing of baked clear enamels on chromium over copper plate on steel, when a scratch was made through the lacquer and chromium into the copper. In many instances the chromium plate was preferentially attacked instead of the copper, and after about 48 or more hours in the salt-spray a bare clean copper area around the scratch was seen. The reason the chromium plate disappeared was because, being tightly covered, it did not retain its passivity because sufficient oxygen could not come into contact with the chromium. Active chromium acts about like zinc or iron in contact with copper and under such conditions the chromium becomes anodic to copper in the presence of the electrolyte and dissolves away laterally. This phenomenon involving active chromium is very important and manifests itself in quite a few ways in plating problems involving chromium and stainless steels. For example, when a stainless steel was plated directly with chromium, superb corrosion protection was obtained in the salt-spray test or outdoors. However, when the stainless steel is nickel plated first (for the purpose of improving the brightness of the surface and decreasing polishing and buffing costs) and then chromium plated, the protection against corrosion in salt-spray and outdoors suffered, and rust spots appeared about as rapidly as if the composite chromium and nickel coating were plated on ordinary steel. This follows from the fact that in order to plate chromium itself or the high chromium steels with an adherent nickel deposit, it must be given a low *p*H nickel strike (or similar treatment) which dissolves off the thin protective oxide and thus these metals are then no longer passive. With chromium plated directly to stainless steel, however, the strongly oxidizing chromic acid bath is capable of plating directly on the stainless steel without apparently appreciably activating it cathodically. When chromium plate was used as an undercoat for nickel which was subsequently given a final chromium plate, or when chromium was sandwiched between two nickel deposits, there was no improvement in outdoor corrosion protection for steel or brass articles.

It was difficult to discern corrosion pits in 1 to 2 mil thick nickel deposits exposed through the pores of the chromium plate, in studies of the early stages of industrial atmosphere exposure tests. However, as the corrosion process proceeded the pits widened at the top where the chromium-nickel couple was most intense. The pores in the chromium were apparently widened by the pressure of the corrosion products of the nickel underneath which in turn caused minute flaking away of the chromium at the site of the pore. The fact that the corrosion pit widened a little faster than it penetrated downward was the reason that the outdoor protection afforded by nickel increased geometrically as the thickness was increased.

This can be seen by a study of the photomicrographs shown in Figs. 4 and 8 of the corrosion pits in chromium plated coatings after exposure of one year and longer in an industrial atmosphere. The example in

Fig. 8 of the chromium plated composite coating of 0.3 mil thick nickel and 0.8 mil thick copper on steel illustrates the damaging effect of lateral corrosion of iron occurring underneath the copper in an industrial atmosphere, once the copper coating is perforated. In the latter case with a composite coating of thin nickel plate, copper deposits should be at least 2 to 3 mils thick for satisfactory service-life on bumper-guards of automobiles in industrial areas.

Acknowledgments

The authors wish to express their thanks to Dr. H. J. Wiesner of Bendix Aviation Corporation for advice and help with rhodium plating; to Mr. M. Weinberg of Parker-Wolverine Division for advice and for comparisons of their studies with his extensive salt-spray studies on plated bumper-guards, and to Dr. R. B. Saltonstall, Technical Director, Udylite Corporation, for helpful suggestions.

References

[1]W. Blum, P. W. C. Strausser and A. Brenner, "Protective Value of Nickel and Chromium Plating on Steel", J. Research Natl. Bur. Standards **13**, 331–355 (1934); **24**, 443–474 (1940). E. M. Baker and W. L. Pinner, "Protective Value of Chromium Plate", J. Soc. Automotive Engineers **22**, 331–334 (1928). E. M. Baker and A. M. Rente, "Porosity of Electrodeposited Chromium", Trans. Electrochem. Soc. **54**, 337–345 (1928). W. Blum, W. P. Barrows and A. Brenner, "The Porosity of Electroplated Chromium Coatings", J. Research Natl. Bur. Standards **7**, 697–711 (1931). D. J. MacNaughtan, "Porosity of Electrodeposits", Trans. Faraday Soc. **26**, 465–481 (1930). N. Thon and E. T. Addison, Jr., "Porosity of Electrodeposited Metals", Monthly Rev. Am. Electroplaters' Soc., April–July (1947). F. Ogburn, "Electrodeposited Coatings for Atmospheric Corrosion Protection", Product Engineering, p. 135 (December, 1949). W. A. Wesley, "Nickel and Chromium Coatings", Corrosion Handbook, edited by H. H. Uhlig, J. Wiley and Sons, Inc., New York, pp. 817–829 (1948).

[2]The subject matter pertaining to electrodeposited foils was presented March 19, 1948 before the Detroit Section of The Electrochemical Society under the title, "Porosity in Electrodeposits", and all of the subject matter except that on rhodium was presented before the Los Angeles Branch of the American Electroplaters' Society.

[3]C. G. Darwin, Phil. Mag. **27**, 315, 675 (1914); **43**, 800 (1922). C. S. Barrett, "Structure of Metals", pp. 221–223, McGraw-Hill Company, New York (1943).

[4]U. R. Evans, "Metallic Corrosion, Passivity and Protection", p. 165, Longmans, Green and Company, New York (1948).

[5]F. L. LaQue, "A Critical Look at Salt-Spray Tests", Materials and Methods (February-March), pp. 77, 78 (1952).

[6]Test developed by C. H. Sample of the Bell Telephone Labs., Inc., New York (1937).

[7]G. A. Lux and W. Blum, J. Research Natl. Bur. Standards **34**, 310 (1945).

[8]U. R. Evans, loc. cit., pp. 8, 270, 271.

[9]N. Thon and E. T. Addison, Jr., loc. cit. Am. Electroplater's Soc. Res. Report, No. 5, pp. 32–36 (1947), (Project No. 6).

[10]H. J. Wiesner, "Some Experiences in Heavy Rhodium Plating", Proc. Am. Electroplaters' Soc. **39**, 79–96 (1952).

[11]C. G. Fink and H. K. Lah, "Deposition of Nickel-Cobalt Alloys", Trans. Electrochem. Soc. **58**, 373 (1930). L. Weisberg, "Cobalt-Nickel Plating", Metal Finishing, p. 318 (June, 1940). A. H. DuRose and P. R. Pine, "New Nickel-Iron Alloy for Electroplating", Steel, June 12 (1944).

[12]W. A. Wesley, loc. cit., p. 822.

DISCUSSION

MR. FUDEMAN (Trico Products Corp., Buffalo, N. Y.): I would like to ask Dr. Brown what experience he has had with white brass and chromium systems?

DR. BROWN: With a metal that is as easily corrodible as white brass and with pores present in bright chromium, the white brass is attacked, both in the salt-spray test and outdoors, and white corrosion products of zinc come out. White brass certainly protects the steel, but you can lose the brilliant chromium surface outdoors if you don't take good care of it, as by wiping the surface often, preferably with wax or oil.

MR. MYRON CERESA (Westinghouse Electric Corporation, East Pittsburgh, Pa.): I would like to ask Dr. Brown if he can explain the difference in the type of corrosion obtained on outdoor exposure between Watts' nickel and a bright nickel plated from a solution with organic additives that contain sulfur. From our observations we have noticed that a Watts' nickel plate will corrode with many small pits while bright nickel plated from the type of solution mentioned will have less pitting but they will be of a much larger diameter.

DR. BROWN: I do not know whether I have a correct explanation, but first of all the chromium porosity pattern does differ, that is, the porosity and crack pattern is different on different types of base metal; also bright nickel is much finer grained than Watts' nickel, resulting in a different corrosion pattern right there.

It is also true, for example, if you put chromium on cold-rolled low-carbon steel of a good grade, and if you put it on electrolytic iron, there is a difference in the chromium porosity pattern, both in the salt-spray test and outdoors. The corrosion protection afforded by the chromium is better on the electrolytic iron. I want to mention at this point that the bright nickels obtained with organic addition agents containing sulfur and carbon, are a little more corrodible than pure nickel, and once an anode point is started, there is a trace greater cathode protection in its vicinity, which would account for the fact that bright nickel has a little wider pit and dull nickel has more pits, but smaller ones. It is somewhat similar to nickel-iron plate versus nickel plate as outlined in the paper.

MR. CERESA: If you compare nickel deposited from a solution containing cobalt as a brightener with those from solutions containing organics of the sulfur type, there is a considerable difference in the type and amount of corrosion. Although these brighteners co-deposit sulfur or cobalt in the nickel plate there is a considerable difference in the ability to remove the stresses in the deposits after chromium plating by a

low temperature heat treatment. What is your explanation of these two apparent differences in these two types of brighteners?

DR. BROWN: Low temperature heat treatment will ductilize nickel deposits that contain a trace of carbon but will not ductilize those containing sulfide. Practically all of the cobalt is in solid solution and is not present as an inclusion.

MR. CERESA: It is our feeling that the type and amount of corrosion in a nickel deposit is a function of the stresses that are formed during the deposition of the nickel. For instance, nickel plates deposited with a PR cycle of 5/120 seconds plate and 1/120 seconds deplate have different corrosion resistance depending on the *p*H of the solution. The higher the *p*H (4.2–4.6) the more stress in the deposit and small pit corrosion is evident. At a low operating *p*H (3.4–3.8) there is no evidence of pit corrosion. These deposits were made from standard nickel plating solutions containing no organic or inorganic brighteners. Your evaluation of our findings would be appreciated.

DR. BROWN: The chromium porosity and stress-crack pattern depends on the stress of the underlying metal which also depends on its crystal size and lattice distances. Changes of *p*H, current density and inclusions all contribute to variations in stress.

I don't know whether your plate was on a complex shaped object. When you plate on a flat panel you get somewhat different results than when you plate for example on bumper-guards, because of difference of distribution of current density, stress, etc.

MR. E. V. COLLINS (Chromium Corporation of America, Waterbury, Conn.): I am interested in knowing how the nickel foil was made.

DR. BROWN: The most common method used to prepare the foil was to plate on fresh bright-nickel that had been passivated by a dip in weak chromic acid and rinsed thoroughly; though we tried many other methods on differently passivated nickel surfaces. We used only those foils that were plated without blistering.

MR. W. B. STEPHENSON, JR. (General Electric Company, Evendale, Ohio): In the plating of rhodium over nickel and chromium over rhodium are any particular cleaning processes needed between the various plates?

DR. BROWN: Rhodium was plated on top of nickel without special cleaning. Several days then elapsed before the rhodium was subsequently plated with chromium. A cathodic cleaner—water rinse—acid dip—water rinse cycle was all that was used before rhodium or the final chromium plating. Higher voltage had to be used in the chromium bath to cover the rhodium.

MR. SAM PIKEN (Briggs Manufacturing Company, Detroit, Mich.): On the basis of your finding that chromium over copper in an industrial atmosphere fails by undercutting of the copper, what do you recommend as far as plating thicknesses of chromium and copper and what can be done to prevent this type of failure?

DR. BROWN: I recommend a good lacquer or enamel.

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Electrochemical Restoration of Bronzes*

Objects of copper and bronze exposed to the elements react with them to form oxides, chlorides, sulfates and carbonates. In the past it has been the practice to remove these products of disintegration, collecting often as a thick crust on the surface of the metal object, either by the use of small chisels or by dipping the whole object in acid. In the course of studies it was discovered that the details of design are retained by the crust and, accordingly, it was necessary to develop a method which would restore the detail. It occurred to investigators that, since the corrosion of metals was due to electrolytic action, it might be possible to reverse this action and reduce the oxides, sulfates, chlorides and carbonates back to metal. When the objects were made cathode in dilute acid solutions, the local action was so severe that the crust dissolved and was not reduced to metal. It became necessary to use a weak solution in which copper showed very low solubility. The solution finally adopted and which has been used for a number of years is a 2 per cent sodium hydrate solution. At first there was concern about obtaining the proper electrical contact, but it soon developed that merely wrapping a soft annealed copper wire over the surface of the object and connecting this to the cathode bar was all that was necessary. As anode, iron and nickel were also used, but it is preferred to use platinum. There are always appreciable quantities of chlorides present in most of the crusts, and these chlorides attack the iron or nickel anode. The heavier the incrustation the lower the current density is used. It is important not to try to hasten matters, as such procedure will generally mean destruction and loss of valuable detail. Many thousands of objects have been restored by this process and a number of interesting facts have been brought to light.

*Excerpt from the article, "Chemistry and Art", by Dr. C. G. Fink. Reprinted through the courtesy of the American Chemical Society which published the material in its publication, Industrial and Engineering Chemistry, in February, 1934.

IRON PLATING FROM AN ALKALINE BATH*

EDWARD F. FOLEY, JR.†, HENRY B. LINFORD‡ AND WALTER R. MEYER**

Abstract

An alkaline iron electroplating solution is described. The solution consists essentially of ferric ion together with sodium hydroxide, triethanolamine, and the sodium salt of ethylenediamine tetra-acetic acid. Data are given on the effects of these variables on cathode efficiency and operating characteristics. A method of adding iron to the plating bath is described. Cathode efficiencies up to 75 per cent were obtained. Cathode efficiencies are strongly influenced by temperature, free NaOH content and current density. Highest efficiencies were obtained with solutions operated at 176° F (80° C) or higher with current densities above 20 amp/ft² and NaOH contents above 100 g/l.

Introduction

Solutions for electroplating iron have been almost entirely acid in nature. Because of this, the throwing power of such solutions has been relatively poor and corrosion has been a problem due to the high operating temperature and the corrosive nature of the solutions. If iron could be electroplated from an alkaline solution, its throwing power characteristics should be better than those of acid solutions and the troubles attendant with corrosion of processing equipment would be greatly reduced. This report deals with an alkaline iron electroplating solution operated at high *p*H. The patent and technical literature on alkaline iron plating baths is relatively meager. Two patents[1,2] describe the reduction of iron oxide to form spongy or powdered iron as a source of pure iron for chemical use. This process would be unsuitable for practical electrodeposition. Two other patents[3,4] describe the use of hot slimes of ferric oxide and caustic soda, and a fifth patent[5] describes the use of a potassium ferrocyanide solution from which a thin film of iron was claimed to have been deposited in from 2 to 4 hours. It is doubtful whether iron can be deposited from ferrocyanide solutions.

The steadily increasing number of chemical compounds available for complexing or sequestering metals and the increased knowledge of their use make it possible that many new and better plating baths might be developed with their use.

The problem is one of reducing the ferric iron concentration of the solution to such a level that the solubility product of ferric hydroxide is not exceeded in the alkaline solution used, while at the same time there is a sufficiently high ferric ion concentration to allow reduction of the ion to the metallic state. Cyanide solutions for example meet the first requirement but do not meet the second requirement. Of the complexing or sequestering agents available, it was decided to investigate first triethanolamine (called TEA) and the sodium salts of ethylenediamine tetra-acetic acid (called EDTA) or mixtures of the two. The chelating and complexing agents considered in this study are salts of ethylenediamine tetra-acetic acid and triethanolamine. It is possible that other complexing agents for iron, such as gluconates and saccharates may be suitable.

Experimental

Equipment

The equipment used in this investigation was the usual equipment found in the electrochemical laboratory. The current was supplied by a selenium rectifier and the anodes used were of iron enclosed in "Orlon" anode bags. Buffed copper was used as the cathode. Current efficiency tests were carried out in a one liter beaker with two electrodes at the sides of the beaker and one electrode in the center. Current efficiency was calculated from the weight gain of the cathode during plating.

The Hull Cell was used to determine the effect of current density on the plate. The Hull Cell used was modified to allow for circulation of the electrolyte by putting a baffled inlet in the center of the bottom of

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†Research Chemist, Enthone, Inc.

‡Professor of Chemical Engineering, Columbia University.

**President, Enthone, Inc.

TABLE I. AMOUNTS OF IRON COMPLEXED PER GRAM OF CHELATING AGENT AT VARIOUS IRON CONCENTRATIONS

Complexing Agents	Molar Ratio	Iron Conc. g/l	Grams of Iron per Gram of Complexing Agent
EDTA*,TEA-cl	†† 1–3	1	0.086
EDTA, TEA-cl	1–3	8.9	0.083
EDTA, TEA‡	1–3.5	9.4	0.075
EDTA, TEA	1–3	9.1	0.071

*tetra sodium salt, ethylenediamine tetra-acetic acid
†triethanolamine hydrochloride
‡triethanolamine

the cell and a trough behind the anode as an outlet. The electrolyte was pumped through the cell using a small centrifugal pump.

The Haring Cell was used initially for throwing power determinations but was discontinued when it was found that the current efficiency changed rapidly with change in temperature. The temperature change in the small compartment of the cell was from 84°–160° F, whereas the temperature change in the large compartment was from 84° to 100° F. As a result of these differences in temperatures, any efficiencies calculated with the Haring Cell would be greatly in error. These temperature differences may have been responsible for many discrepancies reported in the literature on throwing power measurements based on the Haring Cell when the cathode efficiencies of such solutions varied greatly with temperature.

Solutions

Since it had been decided to first investigate solutions in which a mixture of triethanolamine and salts of EDTA were used as the complexing agents. It was necessary to determine the ratio of chelating agent to iron necessary to make up a solution free of precipitate. To determine the amount of iron which is chelated by one gram of chelating agent, a solution of triethanolamine hydrochloride and the tetrasodium salt of ethylenediamine tetra-acetic acid was titrated with a saturated solution of ferrous sulfate until a precipitate was formed. The ferrous salt was used in this test because in the beginning of the experiments it was believed that the iron was present in the solution in the ferrous state. However, later tests indicated that the iron was present almost entirely in the ferric state and iron can be more readily added to the solution by adding it in the ferric rather than in the ferrous state. In making the solutions used in plating, it was found that solutions with higher iron concentrations required a higher ratio of chelating agent to iron to keep the iron from precipitating at the *p*H used (11.5). Sufficient chelating agent was added in each case to bring this precipitate into solution.

The amounts of iron chelated per gram of chelating agent at various iron concentrations are shown in Table I.

Results

The initial plating experiments were done with solutions containing a mixture of the tetra sodium salt of ethylenediamine tetra-acetic acid, with either triethanolamine or triethanolamine hydrochloride. Triethanolamine hydrochloride is a white solid and was used in many cases in preference to triethanolamine because the latter is a hygroscopic, viscous liquid much more difficult to handle. The chloride ion has little or no function in solution with the possible exception

TABLE II. RESULTS OF HULL CELL TESTS

Complexing Agent*	Conc.	Iron Conc.	Temperature Degrees Fahr.	Bright Range (amp/ft²)
EDTA, TEA†	109 g/l	8.9 g/l	80	4.7 to 20.2
EDTA, TEA	125 g/l	9.4 g/l	80	4.7 to 110
EDTA, TEA	125 g/l	9.4 g/l	80	1.5 to 117
EDTA, TEA	182 g/l	8.5 g/l	85–94	25 to end
EDTA, TEA	182 g/l	8.5 g/l	149	25 to end
EDTA, TEA	130 g/l	9.1 g/l	86–93	19 to end
EDTA, TEA	130 g/l	9.1 g/l	148	32 to end
EDTA	188 g/l	20.1 g/l	90	Black coating
EDTA, 8 amp	188 g/l	20.1 g/l	90	Dull black powder
EDTA, 8 amp, *p*H 6.5	188 g/l	20.1 g/l	90	90 to 105
EDTA, 3 amp, *p*H 6.5	188 g/l	20.1 g/l	90	39 to 127

*EDTA = tetra sodium salt, ethylenediamine tetra-acetic acid
TEA = triethanolamine
†Except as noted all Hull Cell tests were run at 3 amperes for 10 minutes.

TABLE III. RESULTS OF CURRENT EFFICIENCY TESTS AT FIXED TEMPERATURE

Complexing Agent	Conc. g/l	Iron Conc. g/l	Current Density amps/ft²	Temp. ° Fahr.	Cathode Efficiency Per Cent
EDTA*, TEA†	130	9.1	29	85	2.9
EDTA, TEA	130	9.1	111	85	3.3
EDTA, TEA	181.5	8.5	29	85	0.9

*tetra sodium salt, ethylenediamine tetra-acetic acid
†triethanolamine

of increasing the anode corrosion to a slight degree. Experiments were run at a *p*H of 11.5 which was the final *p*H when the chelating agent was titrated with iron. Additional experiments were conducted using only the tetra sodium salt of ethylenediamine-tetra acetic acid as the chelating agent and these were run at *p*Hs around 5. The results of Hull Cell tests on these solutions are shown in Table II.

Bright plates over the widest current density range were obtained from solutions using EDTA and TEA as the complexing agents. However, the current efficiencies were very low. The results of the current efficiency tests are shown in Table III.

Current Efficiency

In view of the low current efficiencies, a number of current efficiency tests were run with different solution compositions and at various current densities and temperatures to determine whether changes in any of the several variables would change the current efficiency. The results of these tests are shown in Table IV.

An increase in the chelating agent increases the current efficiency (examples 11 and 12). An increase in the iron concentration with the corresponding increase in chelating agent concentration (examples 14, 15 and 17) results in a decrease in the current efficiency. An increase in the NaOH concentration along with the increase in iron and chelating agent concentration again causes an increase in the current efficiency (14 and 16).

Solutions containing 25 g/l of iron were very viscous and so close to the saturation point that everything which came in contact with the solution was covered with crystals. It was decided, therefore, that 20 g/l of iron was just about the maximum iron concentration for a commercial plating solution of this type.

Since the solution containing 20 g/l iron, 132 g/l EDTA and 154 g/l TEA produced the highest current efficiency of all solutions tested, this solution was used to determine the effect of NaOH concentration, plating temperature, and current density on current efficiency over a wide range. The optimum NaOH concentration (100 g/l) as determined in the initial set of experiments was used to determine the best operating temperature. The same NaOH concentration and temperatures up to 180° F (82° C) were used to determine the effect of current density. It was not considered advisable to use temperatures above 180° F

TABLE IV. RESULTS OF CURRENT EFFICIENCY TESTS WITH VARYING CONCENTRATION; CURRENT DENSITY, TEMPERATURE

Sol	Fe g/l	EDTA* 4 NA g/l	TEA† g/l	NaOH g/l	C.D. amp/ft²	Temp. ° Fahr	Cathode Efficiency per cent	Description of Plate
10	10	99	116	30	100	86–95	1.8	Bright
11	10	99	116	60	100	86–95	3.6	Bright
12	10	66	77	60	100	86–95	2.9	Bright
13	10	66	77	60	100	153	23.0	Bright with matte 1/8″ around edge
14	10	66	77	60	40	158	36.4	Matte
15	20	132	154	60	40	158	28.4	Bright with milky haze over surface
16	20	132	154	120	40	158	53.0	Matte
17	25	165	193	60	40	158	28.4	Bright with milky haze over surface

*tetra sodium salt, ethylenediamine tetra-acetic acid
†triethanolamine

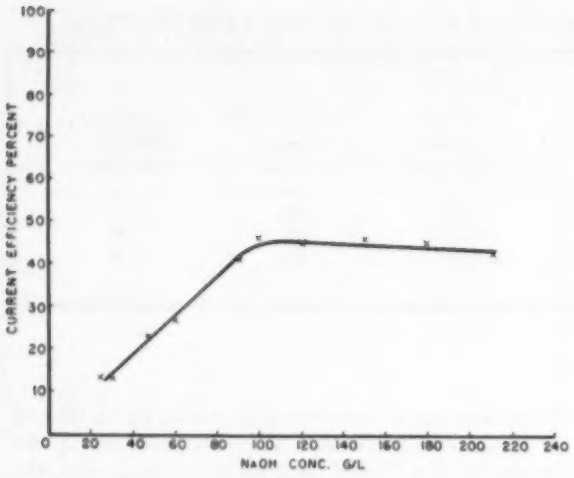

Fig. 1. Current Efficiency vs NaOH Concentration. Iron, 20 g/l; triethanolamine, 154 g/l; tetra sodium salt ethylenediamine tetra-acetic acid, 132 g/l; current density, 40 amp/ft²; temperature, 158° Fahr; time, 10 minutes

(82° C) because of the difficulties which might be encountered with materials of construction at temperatures above this.

The results of these tests are shown in Figs. 1, 2 and 3. It will be seen from Fig. 1 that the current efficiency varies greatly with the NaOH concentration. It rises steadily up to 100 g/l of NaOH. Further additions cause no increase in cathode efficiency. From Fig. 2, it can be seen that temperature has the most profound effect on cathode current efficiency of any variable investigated. At temperatures below 120° F (49° C) the cathode efficiencies are less than 10 per cent. Above 120° F (49° C) the cathode efficiency increases regularly with temperature, reaching 75 per cent at 180° F (82° C). This is somewhat similar to the effects of temperature on the cathode efficiencies of alkaline tin plating solutions. In Fig. 3 it can be seen that cathode efficiency vs. current density goes through a maximum. Fortunately the maximum cathode efficiency is obtained at a practical current density, namely, 20 amp/ft².

The best plating conditions with respect to current efficiency as determined by these tests are as follows:

Fe content of bath	20 g/l
NaOH concentration	100 g/l
Temperature	130° F (82° C)
Current density	20 amp/ft²

However, it must be noted that even though the current efficiency drops off as current density is increased above 20 amp/ft², it does not decrease as rapidly as the number of coulombs passed is increased. Hence the rate of deposition of iron continues to increase as the current density is raised.

The next variable to be investigated was the effect of changing the ratio of EDTA and TEA in the bath. As shown in Table II, solutions containing only EDTA as the chelating agent did not produce satisfactory results. An attempt to make up a solution using only TEA as the complexing agent was unsuccessful as a heavy precipitate formed after adding about 2 g/l of iron. This was true even when 115 g/l Na_2CO_3 was added to keep the *p*H from dropping as the ferrous sulfate was added. It was later discovered that solu-

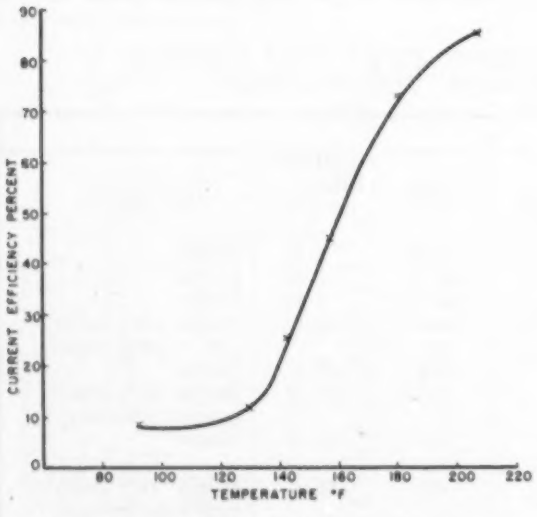

Fig. 2. Current Efficiency vs Temperature. Iron, 20 g/l; triethanolamine, 154 g/l; tetra sodium salt ethylenediamine tetra-acetic acid, 132 g/l; current density 40 amp/ft²; time, 10 minutes

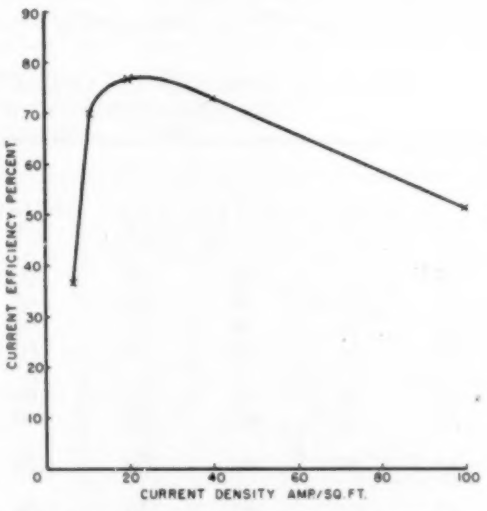

Fig. 3. Current Efficiency vs Current Density. Iron, 20 g/l; triethanolamine, 154 g/l; tetra sodium salt ethylenediamine tetra-acetic acid, 132 g/l; temperature, 180° Fahr; time, 10 minutes

tions could be made using only TEA as the complexing agent if ferric salts were used rather than ferrous sulfate. However, when these solutions were used for plating, the cathode became covered with a green precipitate. This precipitate is probably a basic ferrous salt.

The solutions described in Table V were made up and used for current efficiency determinations. The narrow range of current efficiencies obtained with the wide variation in chelating agent variation, as shown in Table V, indicate that the limiting factors with respect to chelating agent to iron ratio are ease of preparing of solution and the stability of the solution in use. The concentration of chelating agents used in the previous tests was 154 g/l of TEA and 132 g/l EDTA. Solutions containing an excess of either of these agents were easier to make up in that the total quantity of iron could be added without additions of NaOH while those solutions containing less than the above-mentioned concentration required that the iron and NaOH be added alternately in small portions to prevent the formation of a dense precipitate. In use, those solutions which contained less than the usual concentration of either of the complexing agents became filled with sludge while the other solutions did not.

Cathode

The tests made with the Hull Cell showed that these solutions were capable of producing a bright plate over a very wide current density range. Subsequent tests on a number of small buffed copper and brass articles showed that the iron plate reproduced the brightness of the buffed piece before plating and the finished article was a deep silver color. Those coatings which were not bright were gray in color and milky to matte in appearance. An investigation into the conditions under which plating was done showed that the bright coatings produced were all produced at low current efficiency. To determine if this brightness were a function of current efficiency or of thickness of coating, thin coatings were produced at high current efficiency and thin and heavy coatings were produced at low current efficiency. Table VI shows that the brightness is a function of thickness rather than current efficiency.

TABLE V. RESULTS OF CURRENT EFFICIENCY TESTS WITH VARIATION OF COMPLEXING AGENT CONCENTRATION

Sol	TEA* g/l	EDTA† 4Na g/l	Condition of Surface	Cathode Current Efficiency per cent
18	154	198	Matte	68
19	154	66	Matte	75
20	154	132	Matte	72
21	77	132	Matte	71
22	231	132	Matte	66

Fe, 20 g/l; NaOH, 100 g/l; Temp. 180° F
C. D. 40 amp/ft²

*triethanolamine
†tetra sodium salt, ethylenediamine tetra-acetic acid

Throwing Power

Due to the wide changes in cathode efficiency with temperature, determination of throwing power in the Haring Cell was impractical. Therefore, practical tests were made to indicate the throwing power of the solution. It appears to be considerably greater than the throwing power obtained from acid iron plating solutions. Irregularly shaped objects were plated in deep recesses.

Anode

The anode reaction was the next item investigated. The anode bags were removed from the anode and the position of the anode and the cathode reversed so that there was one anode between two cathodes. Using solution 20 and plating for 4.5 hours, the anode efficiency as determined by weight loss was 3 per cent. This low anode efficiency was confirmed by titrating the solution for iron before and after electrolysis. Solution 20 with the addition of 22 g/l of potassium chloride showed an anode current efficiency of 1 per cent after plating for 4 hours under the same conditions. Several additional runs with solution 20 showed no anode weight loss on plating. On one run where

TABLE VI. RESULTS OF BRIGHTNESS TESTS

Cathode Current Density amp/ft²	Temperature ° Fahr	Time min	Cathode Current Efficiency per cent	Weight of Co ating g	Condition of Coating
40	86	10	3.4	0.0237	Bright
40	82–90	90	2.3	0.1422	Milky
40	180	0.5	88	0.0305	Bright

Solution used: No. 22; Fe, 20 g/l; NaOH, 100 g/l; TEA, 231 g/l; EDTA 4Na, 132 g/l

triethanolamine hydrochloride was used in place of triethanolamine and on a second run where hydrochloric acid was added to solution 20, there was considerable anode weight loss. However, the anodes were covered with a heavy green slime which did not go into solution. The addition of hydrogen peroxide to the green slime turned it red, after which it went into solution upon use of a great deal of stirring.

Replenishing the Solution

In view of the low anode current efficiencies, it was attempted to raise the iron concentrations of the bath after plating through the use of either ferrous hydroxide or ferrous carbonate. These two compounds were chosen because their use would not necessitate an elaborate method for the removal of undesirable anion buildup. The attempt to dissolve ferrous hydroxide in the bath was unsuccessful. However, considerable ferrous carbonate was dissolved in the bath after plating.

It was possible to raise the iron concentration of a depleted bath up to 66 per cent of the original iron concentration by adding the ferrous carbonate, heating the bath and then filtering it. A 300 cc bath containing originally 6 g of iron was used for 3 hours after which time 4.47 g of iron had been plated out. The iron concentration in this bath was then raised with ferrous carbonate as described above, after which 2.14 g of iron were plated from the bath under the same conditions for three hours.

Using 300 cc of solution 20, 0.5 g of iron was plated from the bath. After plating, a solution containing 0.5 g of iron as ferric chloride, dissolved in about 25 cc of water, was added to the bath. It went into solution easily. After this addition, an additional 2.7 g of iron was plated from the same 300 cc of solution. (This is 45 per cent of the iron content of the bath.) 2.7 g of iron as ferric chloride were then dissolved in 50 cc of water and added to the bath with constant stirring. The entire quantity went into solution. Mixtures of ferric sulfate and triethanolamine and ferric chloride and triethanolamine were also used successfully in replenishing the iron in a bath which had been used for plating.

Oxidation State of Iron in Bath

Samples of two different batches of solution 20 were titrated with titanium trichloride for ferric ion as recommended by Dr. Earl J. Serfass. Other samples from these same solutions were first oxidized with bromine water and then titrated for total iron. The results of these tests showed that better than 95 per cent of the iron is present as trivalent iron. The oxidation state of the iron in this bath is further illustrated by the fact that no special precautions were taken at any time with regard to the oxidation state of the bath. A solution of the type described has been in successful plant operation for over a year.

LITERATURE CITED

[1]Ernst Mehl, U. S. Pat. 2,389,734, November 27, 1945.
[2]Hugh Rodman, U. S. Pat. 884,763, April 14, 1908.
[3]Axel T. C. Estelle, U. S. Pat. 1,275,161, August 6, 1918.
[4]Axel T. C. Estelle, U. S. Pat. 1,565,353, June 15, 1925.
[5]Jacob B. Thompson, U. S. Pat. 58,037, September 11, 1866.

Contribution No. 30 from the Chemical Engineering Department, Engineering Center, Columbia University, New York, N. Y.

DISCUSSION

MR. MORTON SCHWARTZ (Surface Alloys Engineering Corp., Los Angeles, Calif.): Have you had a chance to investigate the physical properties of the deposits, such as microstructure and brittleness?

DR. LINFORD: No, we have not made a physical examination of the deposit. Mr. Foley, do you have any more recent information on that?

MR. FOLEY: No, we did some strain tests on it, but nothing conclusive was obtained.

MR. SCHWARTZ: Were the deposits more brittle than those obtained from the acid bath?

DR. LINFORD: We have not made any physical tests, but I would not expect them to be more brittle.

MR. E. B. SAUBESTRE (Sylvania Electric Products, Flushing, N. Y.): To what do you ascribe the temperature effect?

DR. LINFORD: We have not measured instability constants of these complexes; however, I strongly suspect that the temperature effect is due to the change in the instability constants. In other words, I believe that at the higher temperatures we have a much higher iron ion concentration, than at the lower temperatures.

Now, that is only a presumption on my part. We have made no measurements.

MR. SAUBESTRE: If amount and ratio of complexing agents does not affect current efficiency, to what do you ascribe the low current efficiency? What is the limiting step?

DR. LINFORD: In the first place, these organic complexing agents form the complexes very slowly. I pointed out earlier that we go from ferric to ferrous to iron, and not directly from ferric to iron, therefore if you have a sufficient amount of ethylenediamine tetra acetate present to prevent the ferrous hydroxide or basic ferrous salts from precipitating, then you can do a satisfactory job of plating.

However, if conditions were such that the complex forms rapidly and you would have in effect, no ferrous ions present, then you would get a very low current efficiency. However, I believe that equilibrium is slow enough to mask the effect of concentration of that complexing agent.

MR. W. A. GRIGAT (Western Electric Company, Kearny, N. J.): What is the maximum thickness of deposit thus far obtained?

DR. LINFORD: Mr. Foley, do you have a figure on that?

MR. FOLEY: About 0.002 inch.

MR. CHARLES A. FORBES (Standard Steel Spring Company, Coraopolis, Pa.): Can a Beckman Spectrophotometer be used for analysis of the complexing agent?

DR. LINFORD: Not to my knowledge.

MR. J. D. FAIRBAIRN (RCA Victor, Montreal, Canada): Can iron plating be oxidized to the conventional black color in the regular manner?

DR. LINFORD: Yes, that is the current one and only application.

MR. LLOYD O. GILBERT (Rock Island Arsenal, Rock Island, Ill.): Dr. Linford, will you please repeat the optimum bath concentrations and conditions of operation.

DR. LINFORD: Actually, the optimum bath concentration is as follows:

Fe content of bath	20 g/l
Complexing agent	154 g/l TEA; 132 g/l EDTA
NaOH concentration	100 g/l
Temperature	180° F
Current density	20 amp/ft²

MR. FULFORTH: There was another question. In order to save time, I just heard from Mr. Foley that 0.002 inch will not necessarily be smooth. I think that will answer that.

MR. STANLEY J. KLIMA (Sperry Gyroscope Company, Great Neck, Long Island, N. Y.): Have you conducted any tests with regard to electroforming iron to a 0.062 inch thickness from any of the alkaline baths?

DR. LINFORD: No.

MR. RICHARD C. BARRETT (Barrett Chemical Products Company, Shelton, Conn.): What effect has annealing on the deposit?

DR. LINFORD: We have not annealed any samples. I might reiterate one statement made earlier, that we have not considered this bath in the development stage, purely in the research stage. We have not covered all of the angles.

I have one more thought to throw out—you might have wondered, since the bath development has not started yet, why we even bother to report. We thought by getting something into print on compounds of this nature, we could stir up more interest—that's the way you get interested in something new in this business—somebody starts reporting on it and others begin to work on it and it is with that idea in mind that we are reporting the results.

MR. ERIC G. SAMPSON, JR. (Chautauqua Plating Company, Falconer, N. Y.): What effect would current reversal have on brightness of deposits?

DR. LINFORD: I have no data on which an opinion could be based.

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Metal Plating by the Egyptians*

Although the application of thin foils of gold and silver to articles of copper and bronze was known to the ancients, as many museum specimens testify, it was only a few years ago that it was discovered that the Egyptians knew how to deposit a film of antimony on copper by chemical methods. It came about in the cleaning of an ewer and a basin of the fifth or sixth dynasty (about 2500 to 2000 B.C.) belonging to the Egyptian Department of the Metropolitan Museum of Art. During the cleaning operation a white, silvery plating was found on the surface of both the ewer and the basin and, on careful analysis, also found present in this coating was a small amount of iron. The assumption that the antimony might have been applied by a fire process was soon dispelled and the presence of the iron gave a clue. After numerous trials, starting with those chemicals available to the Egyptians five thousand years ago, it was possible to reproduce this antimony plate on copper by either of the following two methods: Method 1 used 20 grams of "natron", 1 gram of antimony sulfide, and 100 cc of water. The natron was artificially made according to an average of the analyses given by Lucas. The solution of natron and antimony sulfide was brought to boiling and pieces of bright copper were immersed in it. Within a short time, a silvery coating was deposited on the copper. This deposit took a good polish on a cotton buff. The reaction is probably due to interaction between metallic copper and sodium thioantimonite. The plate is relatively hard; evidence of this is shown also in the fact that the antimony bottoms of the ewer and basin had not worn off during the life of the articles before they were buried in a tomb thousands of years ago, and both articles showed much wear, so that they were evidently not new when put into the grave where they were found.

The second chemical method of applying the antimony coat which the Egyptians may have used was as follows: One liter of vinegar, 200 grams of sodium chloride and 5 grams of antimony oxide. The copper articles held in contact with iron, when immersed in the bath, acquired a beautiful coating of antimony.

*Excerpt from the article, "Chemistry and Art", by Dr. C. G. Fink. Reprinted through the courtesy of the American Chemical Society which published the material in its publication, Industrial and Engineering Chemistry, in February, 1934.

Convention Echoes II

The Social Program

In keeping with a time-honored tradition, the International Fellowship Club Open House was once more a high spot of the Convention. The sponsors of the affair, the Metal Finishing Suppliers' Association are to be highly commended for the rousing success of this hospitality function. An extra helping of enjoyment was measured out to the lucky winners of $25 Defense Bonds at the Open House: E. M. Siewart of Wichita, Kans.; Ethel Cherry of Huntington Woods, Mich.; H. C. Holbert of Syracuse, New York, and Frank Tirendi of New Haven, Conn.

That pleasantly anticipated cruise aboard the "Delaware Belle" down the Delaware River was favored with excellent sailing weather. A more enjoyable and relaxing afternoon would be most difficult to find. Activities aboard the vessel found the ladies busily occupied with their prize-laden Plato Party, the men leisurely strolling across the decks and the children enjoying the ice cream and cake portion of the catered luncheon. Some of the veteran sea voyagers were seen getting their fill of sunshine while others relaxed in cushioned comfort.

About 75 golfing Conventioneers made the rounds of the perfectly conditioned course of the Merion Golf Club. Walking off with the prizes of this M. F. S. A. sponsored event were the following: George Zurenda, Industrial Service Corporation, Elmira, N. Y., winner of the trophy with a low gross score of 78; Ed Mahar, Atlas Powder Company, Stamford, with a low net of 66, winner of a golf bag; Bill Sweet of General Electric, Syracuse, N. Y., winner of a turf seat with a low net of 71. Matching this last score brought Bill Ross, Wagner Brothers, Detroit, a Home Golf practice set; and low net scores of 72 found Bert Ames, Mans and Waldstein and Jim Mueller, Plating Institute, picking off the prizes of a cashmere sweater and a windbreaker.

No convention would be complete without the final social function, the Banquet. The Philadelphia Banquet lived up to the previously established high standard for good eating. In addition to the food, there was an unusually fetching revue in which several of the A. E. S. members revealed, for the first time, their remarkable agility in a novel bit of choreography. Outstanding for their unrehearsed demonstration of ballet were: M. B. Diggin, Phil Ritzenthaler, Art Pierdon, Art P. Logozzo, Bill Trusdell, Jim Weaver, Bert Kirchoff, George Long, Bill Marcovitch, Joe Eisele, Burt Daw, Manson Glover, Herb Head, George Schore, Brooks Ricca, Tom Morgan, and Ed Zurbach,

Among the various prize awards made during the week were those of a pair of wrist watches, courtesy of J. J. Siefen Company, to Mr. and Mrs. J. H. Farmer of Saginaw, Mich.; a tape recorder to Chicago Branch Secretary Paul Glab; a three-piece silver service to Mrs. Florence Morgan of Philadelphia, and a deep fat fryer to Mrs. William Blum; these last prizes through the courtesy of Hanson-Van Winkle-Munning Company.

The Business Session

The final business session of the 40th Annual Convention began with a roll call of the Past Presidents in attendance. Those answering this roll call were: E. J. Musick, H. A. Gilbertson, T. F. Slattery, E. Steen Thompson, F. Fulforth, E. T. Candee, G. Wagner, K. M. Huston, S. S. Johnston, A. W. Logozzo and W. J. Neill.

Appointments and Awards

Appointments to the Research Committee were announced, with L. Borchert, E. Parker and R. J. Racine drawing the assignments. Dr. E. J. Serfass is now Research Committee Chairman, replacing Dr. Price. L. Borchert assumes the duties of Vice-Chairman, Research, replacing Dr. Serfass. R. Ledford assumes the duties of Vice-Chairman, Finance, replacing Clyde Kelly.

L. Diveley, F. Fulforth and D. Gray were announced as new appointees to the Editorial Board of the staff of Plating.

Dr. R. A. Schaefer presented a report on behalf of the Membership Committee and noted that Society membership had passed the 6,000 mark by the end of the fiscal year. Awards were made to those Branches whose membership had increased the largest amount. Angelo Amatore accepted the award for the New York Branch, winner in the first group; Manuel Ben accepted the award for the Saginaw Valley Branch, winner in the second group; and Joseph Sterling accepted the award for the Louisville Branch, winner in the third group.

Branch Exhibits Awards was the next item of business. Judges George Schore of the New York Branch, Phil Ritzenthaler of the Milwaukee Branch and Lee Merriman of the Sydney, Australia Branch selected the Columbus Branch as winner in this competition with the runner-up spot being taken by Boston. Individual exhibits awards were made to Bell and Howell Company, to Ezra Blount and to Belmont Casket Company on a first, second and third basis, respectively.

Resolutions

A resolution to amend the Constitution and By-Laws of the Society for greater freedom in election of delegates and for clarifying requirements for representation at meetings of the Supreme Society was approved. The resolution:

Whereas: the desirability of holding Interim Meetings for the purpose of hearing reports and proposals when it shall appear to be for the good of the Society is now recognized in our By-Laws (Article VI, Section 9) and

Whereas: it is also of advantage that Delegates who sit in Annual Meeting be those who have had the benefit of hearing Interim Meeting reports and proposals and discussions related thereto; and

Whereas: under the present provisions of the Constitution newly elected Delegates may not be accredited in time to permit this desirable end; be it therefore

Resolved: that the following revisions be made in the Constitutions and By-Laws of the Society:

Constitution: Part I, Article I, Section 1.

Organization. From the end of the first sentence strike out the words: "in Annual Meeting".

By-Laws: Part I, Article III, Section 2.

Credentials Committee; Strike out the section and substitute the following: The Credentials Committee shall be empowered to accept at any time the credentials of duly elected Delegates, subject to review by the Supreme Society in Annual or Special Meeting (but not in Interim Meeting). In preparation for each Annual or Special Meeting it shall consider all credentials and proxies of Delegates and shall present its findings for action by the Meeting.

By-Laws: Part I, Article VI, Section 3.

Alternates; At the end of the Section add the following sentence: A Branch may cast a number of votes equal to the number of its duly accredited Delegates provided that it has one such Delegate (or accredited Alternate) present on the floor.

By-Laws: Part II, Article VII, Section 1.

Delegates; At the end of the first sentence strike out: "at least one month before the Annual Meeting" and substitute: "by such procedure as the Branch may establish". At the end of the first paragraph strike out: "not later than the fifteenth day of May" and substitute: "at least fifteen days prior to the Annual Meeting or to a Special Meeting which the said Delegates are to be accredited. Delegates shall serve until their successors are duly elected and accredited". Strike out the second paragraph, of which such parts as properly relate to Branches are covered elsewhere and the rest in Part I.

A resolution pertaining to the proposal to amend the constitution for greater free-

dom in selection of convention dates was approved by the Delegates. The resolution as adopted:

WHEREAS: The Constitution of the Society now designates for the Annual Convention the four warmest months of the year; and

WHEREAS: these months are in certain cities otherwise eligible and well equipped for the entertainment of the Convention so extreme in heat that for humanitarian reasons they are barred from consideration; be it therefore

RESOLVED: that, to relieve the entailed hardship and to make possible when it may seem desirable the holding of the Convention in these cities,
the Constitution of the Society, Part I, Article VI, Section 1, be amended as follows:

Strike out the second sentence and substitute: "The Annual Meeting and Convention shall be held on dates agreed upon by the Executive Board and the Branch designated to entertain the Convention, hereinafter called the Host Branch".

A resolution relating to an A. E. S. Bronze Medal was also approved by the assembled Delegates. The resolution:

WHEREAS: The Grand Rapids Branch has realized the desirability of recognizing the writer of the third best paper printed in Society publications during the fiscal year by awarding him an A. E. S. Bronze Medal and,

WHEREAS: The Grand Rapids Branch has appropriated the necessary funds from its Branch treasury to pay for the striking of the bronze medals and for the annually recurring engraving charge,

BE IT RESOLVED:

(1) That paragraph 2 (c) in our Constitution and By-Laws Appendix under Paper Awards dealing with "A Certificate of Honorable Mention . . ." be deleted and replaced by the following:

(c) The A. E. S. Bronze Medal with an award of $15.00 for the third best paper printed in Society publications during the fiscal year.

(2) That the Supreme Society extends to the Grand Rapids Branch its hearty thanks for its generous, thoughtful action.

Dr. Swift then presented his budget report which was accepted as read on motion.

An announcement of the resignation of Dr. D. G. Foulke as Executive Secretary was made.

A resolution on the subject of publication format changes was adopted. The resolution:

WHEREAS: the Editorial Board and the Executive Board contemplate a substantial change in policy relating to the publications of the Society: and

WHEREAS: these groups desire the guidance of the Supreme Society in this important step; therefore be it

RESOLVED: that this Annual Meeting endorses the following Publications policy: that

(1) all technical papers presented to the Society, including those presented during Annual Convention, be published in PLATING.

(2) all papers presented in Annual Convention be published, with discussion, as soon thereafter as possible.

(3) the annual *Proceedings* be enlarged to include not only Convention papers but also all technical papers published in the official Journal.

The resolution pertaining to a broadening of the base of the Society's operation was also approved. The resolution:

WHEREAS: the Interim Meeting at Columbus, through the analysis by Leonard Weeg of Rockford Branch and the extended discussion that followed, brought out clearly the opportunities for enlargement of the membership and usefulness of the Society within its object as set forth in the Constitution by increased attention to arts and sciences related to electroplating; be it therefore

RESOLVED: that this Annual Meeting recommends to the Editorial Board and others concerned an exploration of suitable means for the accomplishment of such expansion.

The delegates of the Baltimore-Washington Branch, having submitted to the Supreme Society by mail both a resolution designed to express the thinking of the Supreme Society relative to the recent dismissal of Dr. Allen V. Astin, Director of the National Bureau of Standards, and supporting material, including a copy of a pending bill H.R.5043, submitted the following resolution revision for consideration and action. The revised form, published below, was approved.

WHEREAS: The American Electroplaters' Society, as a result of many years of pleasant and helpful association, holds our National Bureau of Standards in high esteem, and,

WHEREAS: The American Electroplaters' Society and the plating and finishing industry as a whole appreciates sincerely the many fine, truly scientific papers which are the fruit of devoted, painstaking work on the part of Bureau of Standards personnel,

BE IT RESOLVED: That the American Electroplaters' Society deplores the unfortunate reflection on the integrity of both the director of the Bureau of Standards and the Bureau of Standards staff of scientists contained in the unwarranted dismissal and subsequent clouded reinstatement of Dr. Allen V. Astin, and urges not only that the results of a thorough impartial investigation be made public as soon as possible, but also to minimize the possibility in the future of similar actions, so devastating with regard to personnel morale and Bureau prestige.

(It is proposed, assuming that this resolution is adopted by the Supreme Society assembled in regular Annual Meeting, that:

(1) A copy will be sent to the President of the United States by the President of the American Electroplaters' Society.

(2) A copy will be sent to each delegate for his information and possible action.

(3) A sufficient number of copies will be sent to each Branch Secretary for distribution to appropriate Representatives and Senators with a suitable covering letter.

(4) This action be made known to our members through publication in an early issue of PLATING.

(5) This action be made known to the general public by means of a news release to the press, trade journals and other Technical Societies.)

A communication was acknowledged from the Toronto Branch in which the group requested Society consideration of the Royal York Hotel in Toronto as the site of the next Interim Meeting.

Mr. R. J. Wooley of the Los Angeles Branch made known a letter from the Adelaide Branch in which they expressed fears of a membership loss of as high as 50 per cent because of the one dollar dues increase. The unfavorable monetary exchange rates between the U. S. and Australia work to the disadvantage of the members in the latter country.

Also adopted was a resolution presented by the Boston Branch expressing wishes for the speedy recovery of Founder Member George B. Hogaboom who was suddenly stricken with a coronary occlusion that morning.

Also read was a wire from the Japanese Electroplaters' Association in which they expressed wishes for a successful A. E. S. convention.

Election of Officers

The next order of business was the nomination and election of Executive Board officers for the coming year.

Nominating speeches were delivered by Manson Glover and Herberth Head who presented Dr. G. P. Swift as candidate for President. Similarly presented were Dr. R. A. Schaefer for the office of First Vice-President by Eugene Combs and Myron Diggin; Clyde Kelly for the office of Second Vice-President by P. Ritzenthaler and E. Blount; Dr. S. Heiman for the office of Third Vice-President by F. Fulforth and Dr. William Blum.

These men were then formally elected.

Following the election, short progress reports on the status of the 1954 New York Convention, the 1955 Cleveland Convention and Industrial Finishing Exposition and 1956 Washington, D. C., Convention were presented by G. Schore, E. Combs, and A. Pierdon, General Chairmen for those meetings.

The requests of representatives of the Columbus, Ohio and Montreal Branches for delegate approval of their petitions for the 1957 convention were resolved by a roll call vote in favor of Montreal by a vote of 63–54.

Adjournment of the meeting brought an official closing of the business sessions of the 40th Annual Convention.

CONVENTION PHOTOS

(1) *A. E. S. notables at the Opening Session of the Society's 40th Annual Convention, Benjamin Franklin Hotel*

(2) *A. E. S. National Officers at the Monday morning session*

(3 and 4) *Registration Desk at the Headquarters Hotel*

(5) *One of the well-attended educational sessions*

(6) *Dr. and Mrs. Blum meet Australian Delegate Merriman. Merriman had been in welcoming party when the Blums landed in Australia*

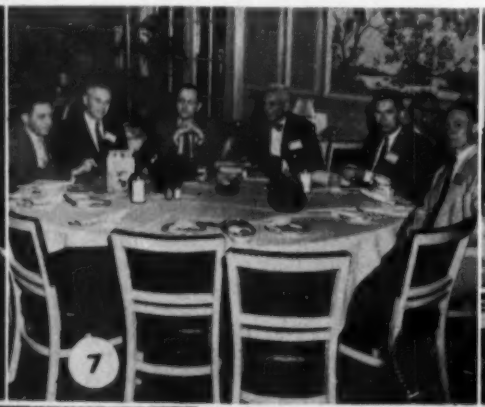
(7) *First educational session speakers at breakfast prior to meeting*

(8) *Speakers' panel at Question & Answer Session, Tuesday evening*

(9) *Highly successful Question and Answer session found groups still discussing various problems even after the formal closing of the session*

(10) *Induction of new A. E. S. National Officers for 1953–1954 by Past President Fulforth*

(11) *Speakers of Fourth Educational session at breakfast*



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CURRENT AND METAL DISTRIBUTION IN ELECTRODEPOSITION

III. EXPERIMENTAL DETERMINATION OF METAL DISTRIBUTION

project no. 11

project director:
JOHN KRONSBEIN*

location:
EVANSVILLE COLLEGE,
EVANSVILLE, IND.

Acknowledgement is due the Research Committee, Dr. W. A. Wesley, The International Nickel Company, Chairman; the Research Directing Sub-Committee, Mr. G. M. Cole, Ternstedt Division, General Motors Corporation, and Dr. R. A. Schaefer, Cleveland Graphite Bronze Company, Chairman and District Supervisor, respectively; and the Project Committee, Dr. R. A. Schaefer, Acting Chairman; Mr. L. R. Westbrook, Consultant, Solon, Ohio, and Mr. R. W. Oyler, Guide Lamp Division, General Motors Corporation, for their contributions to this project.

*AUTHOR

This paper presents data obtained by measuring the metal distribution on the interior surfaces of right angle specimens of various shank lengths and fillet radii when plated in a specially designed shielded box at two average current densities in highly purified acid copper sulfate, Rochelle type copper cyanide, and Watts' nickel baths of conventional composition. The object of this work was to determine metal distribution under favorable conditions in order to show the effects of fillet radius and shank length in plating on recessed surfaces. From these data and the general conclusions drawn therefrom, the plater will be given a guide of metal distribution on given shapes and indications on how to proceed in making design changes to improve uniformity of plate. This information may serve as a basis for estimating the relative metal distribution at various places on interior surfaces of recessed objects.

Summary

The net results of this work show that fillet radius has very little effect on thickness of deposit in corners and along the adjacent shanks when such radius exceeds about 0.02 inch per 2 inches of shank length; hence, every effort should be made by designers not to go below this figure.

Description of Experiments

A. *Plating Baths*

The three plating baths used were of conventional composition. All baths were 100 liters (27 gallons) in volume, contained in rubber lined steel tanks. Plating grade chemicals and distilled water were used in making them. The baths were made up and purified in accordance with the following formulations and procedures.

1. *Acid Copper Sulfate Bath*

Composition:
$CuSO_4 \cdot 5H_2O$ . . . 215 g/l (28.6 oz/gal)
H_2SO_4 . . . . . 65 g/l (8.65 oz/gal)
Anodes: Cast copper in Vinyon plastic bags
Purification: The bath was first agitated with activated carbon for 18 hours at room temperature, then filtered, using a Hastelloy "B" pump and rubber-lined equipment. The bath was then dummied at room temperature for 600 ampere hours at 5 amp/ft², then for 3000 ampere hours at 20 amp/ft², using a corrugated cathode and calculating current density on projected area.

2. *Rochelle Copper Cyanide Bath*

Composition:
CuCN . . . . . 26 g/l (3.46 oz/gal)
NaCN . . . . . 35 g/l (4.66 oz/gal)
Na_2CO_3 . . . . . 30 g/l (4.0 oz/gal)
$KNaC_4H_4O_6 \cdot H_2O$
(Rochelle Salt) . . . 45 g/l (6.0 oz/gal)
Anodes: Cast copper in cotton bags
Purification: The bath was first treated with activated carbon for 18 hours at 165° F, then filtered, using a Hastelloy "B" pump and rubber lined equipment. The bath was dummied at 122° F for 600 ampere hours at 5 amp/ft², then for 3000 ampere hours at 20 amp/ft², using a corrugated cathode and basing current density on projected area.

3. *Watts' Nickel Bath*

Composition:
$NiSO_4 \cdot 7H_2O$ . . . . . 240 g/l (32 oz/gal)
$NiCl_4 \cdot 6H_2O$ . . . . . 45 g/l (6 oz/gal)
H_3BO_3 . . . . . 30 g/l (4 oz/gal)
*p*H . . . . . 2.5 (electrometric)
Anodes: Rolled depolarized nickel in cotton bags

Purification: The bath was first heated to 200° F and after the addition of nickel carbonate and 0.2 ml/l of 30 per cent hydrogen peroxide it was agitated for 4 hours. The bath was then filtered, using a Hastelloy "B" pump and rubber-lined equipment, cooled to 122° F, the *p*H adjusted to 2.5 (electrometric) with c.p. H_2SO_4, and after an addition of 2 lb activated carbon it was agitated for 18 hours, followed by another filtration.

B. *Maintenance*

All baths were regularly treated with activated carbon and dummied during periods when no specimens were being plated. The compositions were maintained by periodic analyses. The free cyanide in the Rochelle bath ranged from 6 to 8 g/l (0.8 to 1.07 oz/gal) while the *p*H of the nickel bath was held between 2.4 and 2.6 (electrometric).

C. *Specimens*

The specimen pieces to be plated measured approximately 2⅝ inches high by 4 inches wide and were formed into a right angle so that each shank length measured two inches. Plating on shank lengths of less than two inches was accomplished by masking off the excess length and decreasing width of box proportionally. The shank lengths studied were 0.75, 1.125 and 2.0 inches, respectively. The fillet radii of the specimens plated measured 0.005, 0.010, 0.021, 0.032, 0.062, 0.092, 0.125 and 0.1875 inch, respectively.

The specimens with a 0.005 inch radius were made from a structural angle with a milled-out inside corner. A side milling cutter was selected for this operation to control the radius and two cutting surfaces. To retain rigidity while machining, the pieces were made approximately 1/8 inch thick. The resulting tool marks were removed by electropolishing.

All specimens with a radius of 0.010 inch or greater were formed in a 90-degree plunger and receptacle type die set under constant pressure. The various radii were obtained by redressing the nose of the plunger die for each step. These pieces (0.017 inch thick) were easily formed under these conditions mainly because it was not necessary to hold the 90-degree angle accurately. The method of support within the specially designed plating box, described later, automatically located the angle with near perfect accuracy.

All specimens were machine ground and polished with No. 000 paper on both ends for subsequent measurement of the fillet radii. The pieces were checked under a magnification of 10X to 55X, depending upon the radius range. The measurements were made by direct projection of the parts upon master circle guides according to a predetermined scale.

The backs of the specimens were masked with stop-off lacquer. Contact plates were made from scrap specimens by soldering a copper wire to the outside, raising four points on the inside by means of a punch and masking the whole with stop-off lacquer. Contact was made between the specimen and plate when the lucite pressure plate in the box specimen holder was screwed into position. This caused the four points to pierce the masking material on the backs of the specimens.

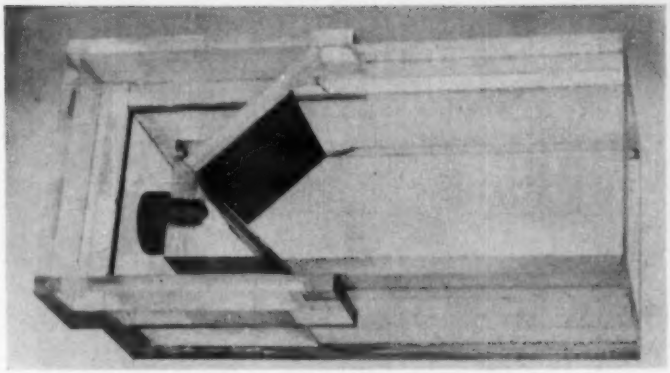


Fig. 1. Uniform current density cell for right angle cathodes

It should be noted that by masking the back of each specimen and plating it in the specially designed specimen holder or plating box to be discussed under the next heading, all the metal deposited was plated on the internal surfaces of the angle. None was deposited on the back and because of the box design, there was no build-up of plated metal on the edges

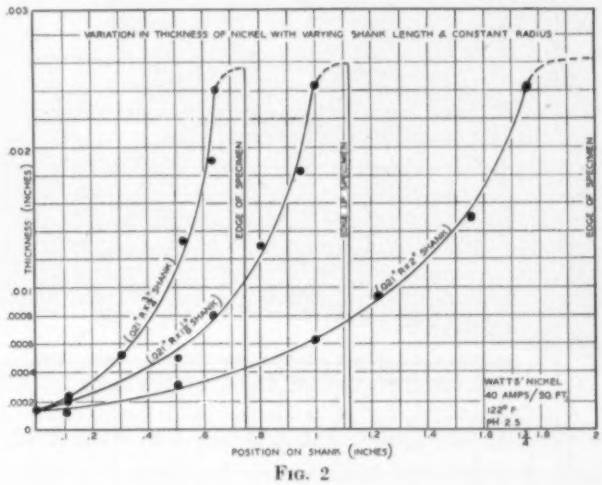


FIG. 2

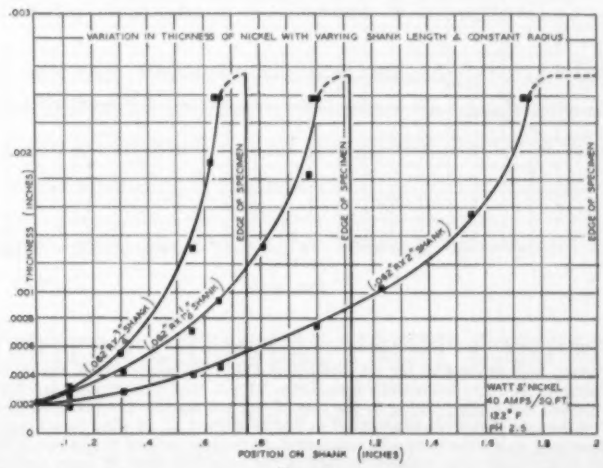


FIG. 3

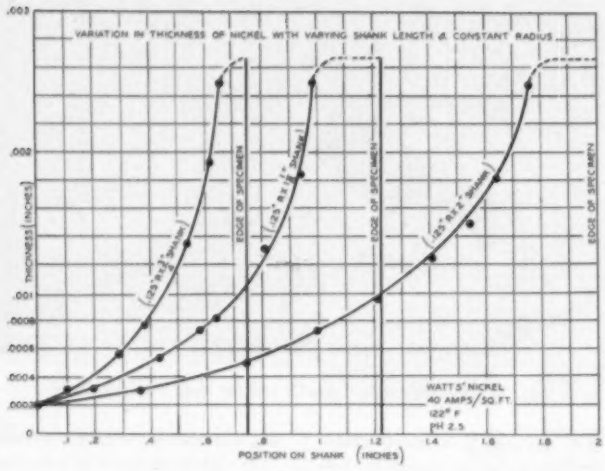


FIG. 4

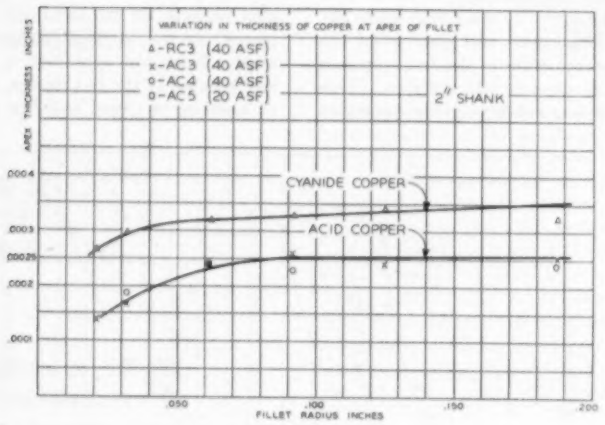


FIG. 5

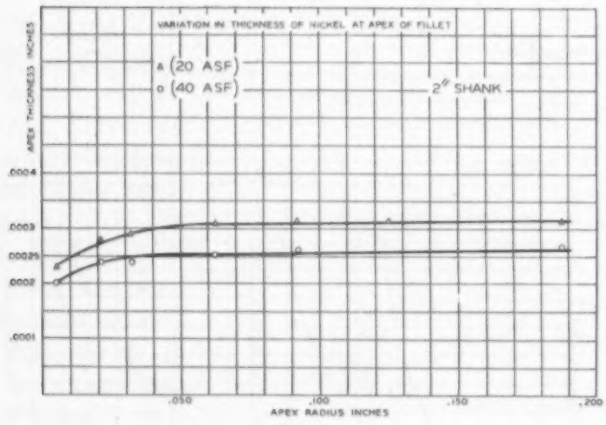


FIG. 6

of the specimen, in contrast to the condition illustrated by Fig. 7 of Part II of this series[1]*.

D. *Specimen Holder or Plating Box*

In order to assure deposition of all the metal plated on the interior surfaces of the angle specimen in proportion to the current distribution over those surfaces and thus avoid the necessity of introducing errors incident to the application of purely theoretical or mathematically computed correction factors, a special specimen holder was used as described by R. A. Schaefer and H. Pochapsky in their paper, "Some Practical Considerations of Current Distribution"[2].

The specimen holder used in this work is shown photographically in Fig. 1. The ends of the top and bottom lucite shield locators were rounded to conform to the increasing radii of the specimens and to permit seating of the shank edges in the side shields. The total current used was not changed with increasing radius. The largest radius (0.1875 inch) only effected a reduction of approximately 1 per cent in the total specimen area as compared to that of the 0.005 inch radius specimen.

E. *Technical Procedure*

After mounting the specimens in the plating boxes, the following pretreatment procedures were used:

1. Hand scrub with magnesium oxide paste
2. Rinse
3. Pickle one minute in concentrated hydrochloric acid
4. Rinse
5. Copper flash one minute at 20 amp/ft^2 in Rochelle copper bath
6. Rinse
7. Plate

The specimen was totally immersed in the solution and current leakage to the backs of the specimens effectively prevented.

In every case a contrasting backing metal was plated over the metal under investigation in order to minimize smearing during polishing and to provide a sharp line of demarcation for the observer during measurement.

F. *Procedure Used for Metallographic Inspection of Deposit Thickness*

The specimens were cut at the midsection along both legs and radius with a jeweler's saw. After deburring, they were mounted in plastic. Polishing of the edges and etching were carried out essentially as described in A.S.T.M. brochures E-2-

*This theory was developed for an "infinitely thin" flat strip which has no edge. What is termed "edge" here is 23 per cent of the cathode distance, starting from the edge. Thus, 21 per cent excess plate is found within 23 per cent of the distance from the edge of the flat strip toward the center, owing to the rise of current density toward infinity. In the case of the boxed-in specimen, a flat strip would be nearly uniformly plated, as illustrated in Fig. 5 of Part II, so that direct comparison is possible without mathematical computation. This is important as mathematically computed correction factors would apply only to solutions inducing no cathode polarization, a condition that is not true with respect to any of the solutions used in these experiments. It was for this particular reason that the special shield was designed and used in this work.

44T and E-3-46T, where details of etching solutions are also given.

The results of measurements are plotted on the accompanying graphs, Figs. 2–6 inclusive. It should be pointed out that while the shielding box provides a direct comparison with uniform deposit distribution, the comparison is one that involves a definite jump from entirely uniform distribution to some entirely non-uniform distribution with a definite edge effect, since even with the shielding box the current density at the edges of the angle-shaped specimens is theoretically infinitely high. The graphs bear out this statement.

Fig. 2 represents the variation in thickness of nickel along the shank with varying shank lengths and constant fillet radius (0.021 inch). Figs. 3 and 4 represent the same data for different fillet radii (0.062 inch and 0.125 inch) and show the same trend.

Fig. 5 represents the variation in thickness of copper from both acid and cyanide baths at the apex of the fillet with the fillet radius. It will be seen that the radius has practically no effect on the relative amount of metal deposited in the apex when the fillet radius is greater than about 0.025–0.050 inch.

Fig. 6 presents the same data for nickel at two current densities that Fig. 5 does for copper; namely, the variation in thickness of metal at the apex of the fillets with different fillet radii. Again it shows that the fillet radius has very little effect on the amount of nickel deposited in the apex when the fillet radius is greater than about 0.02–0.05 inch, particularly at higher current densities. At lower current densities there is more of a tendency for relatively heavier deposits as the fillet radius increases up to about 0.10 inch.

Conclusions

The graphs show that the fillet radius has very little effect on thickness of deposit in corners if the radius exceeds about 0.020 inch per 2 inch shank length.

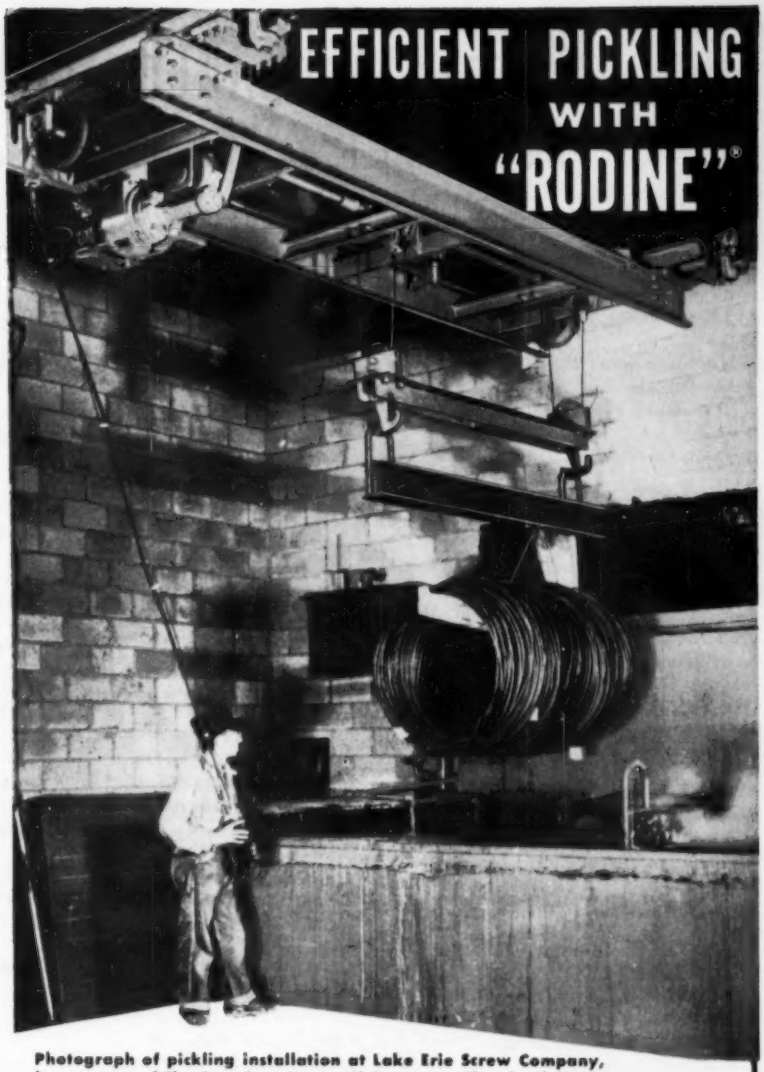
For fillet radius above this quantity, the formula given in Part II, (9)[1]; namely, C.D. = R/12.3 may be used. The low slope is well within accuracy limits of the graphs for such corner fillets.

When the fillet radius is less than about 0.020 inch per 2 inch shank length, the amount of metal plated in the fillet decreases rapidly with decrease in fillet radius. The figures to be expected as corner thicknesses may be extracted direct from the graphs in this paper.

The foregoing applies to all angle shaped articles that are arranged fairly closely side-by-side in a large tank with anodes at least 8 to 12 inches distant from the cathodes.

REFERENCES

[1]Plating **39**, 165–170 (February, 1952).
[2]Proc. Am. Electroplaters' Soc. **38**, 155-166 (1951).



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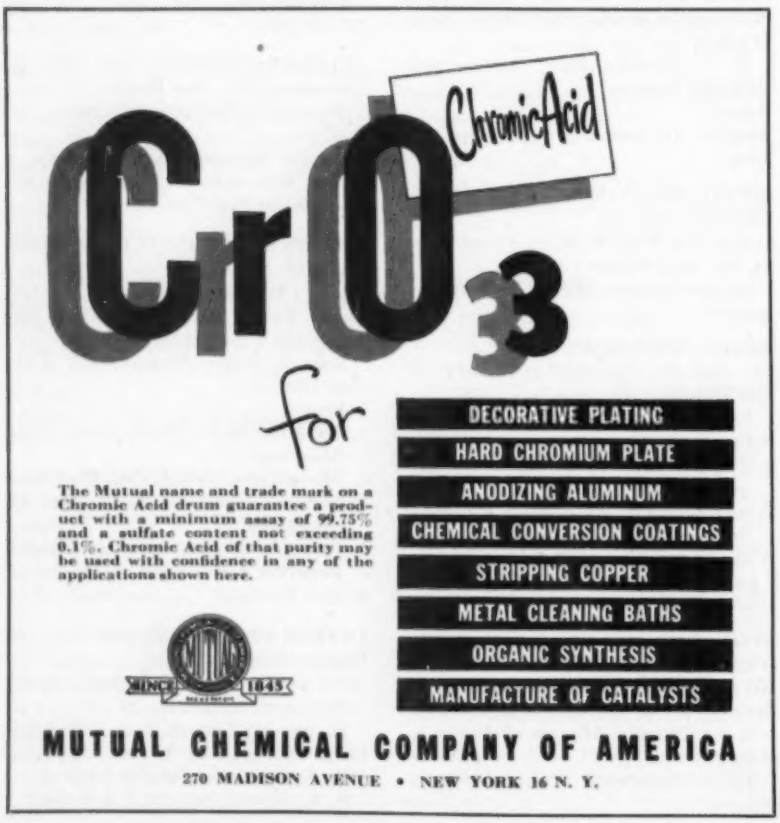
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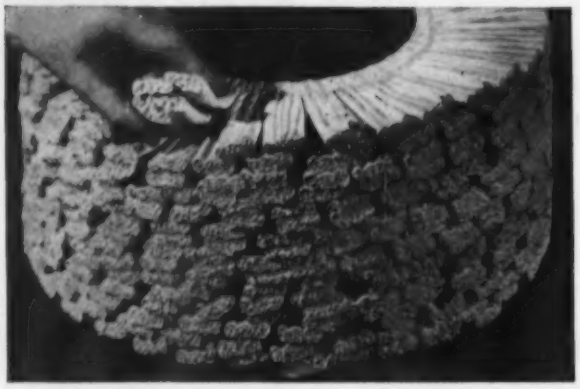

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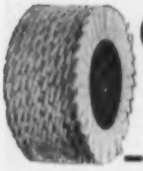

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Book Review

DR. HAROLD J. READ

Professor of Metallurgy, Pennsylvania State College

APPLIED INORGANIC ANALYSIS by W. F. Hillebrand, G. E. F. Lundell, H. A. Bright and J. I. Hoffman, 2nd edition, 1953, xxii + 1034 pages. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $15.00.

Like its predecessor, the first edition, this book is primarily an extensive treatise on what might be called "classical" inorganic analytical techniques, that is, those involving the separation of the constituent elements of the sample, the preparation of pure compounds of the elements, and the weighing of the compounds. The great fund of analytical knowledge of rocks, minerals, refractories, alloys and other inorganic bodies, both natural and synthetic, which was accumulated during the 19th century and the early part of the 20th owes its being largely to classical techniques. Even though the modern analyst does much of his routine work by means of rapid physical or chemico-physical methods involving specialized instruments, he cannot really consider himself a master of his profession unless he is thoroughly familiar with the theory and application of the fundamental chemical methods. For it is these which are necessary for the standardization or proof of other approaches to a given analytical problem.

Since its appearance nearly 25 years ago, there have been few books in its field as authoritative, clear and explicit as "Hillebrand and Lundell". In the new edtion the junior authors, Bright and Hoffman, have ably revised and augmented the text to modernize it thoroughly without losing any of the values which their late colleagues worked into the first edition. One regrets only that with four authors it is no longer convenient to refer accurately to the book in ordinary conversation by mentioning only the authors' names, a procedure which is the hallmark of a useful and authoritative book.

Although the general arrangement of the first edition has been retained, there is new material in every chapter, some of which have been entirely rewritten. The treatments of elements which have come into prominence recently, such as uranium, zirconium, titanium and columbium, have been much expanded and are typical of the modernization of the book.

Although the book still deals primarily with chemical techniques and the details of their application to specific problems of analysis, brief discussions of the newer physical methods have been inserted for guidance as to their applicability, but working directions are not given for specific analyses.

There is no doubt but that this book should be in the library of every analyst who is worthy of the name.

—H. J. READ.

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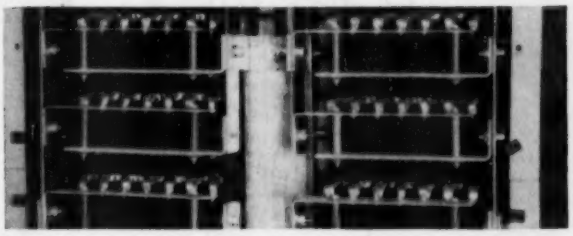

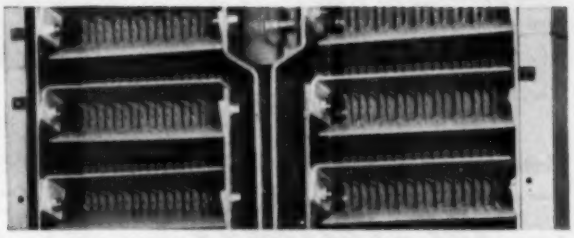

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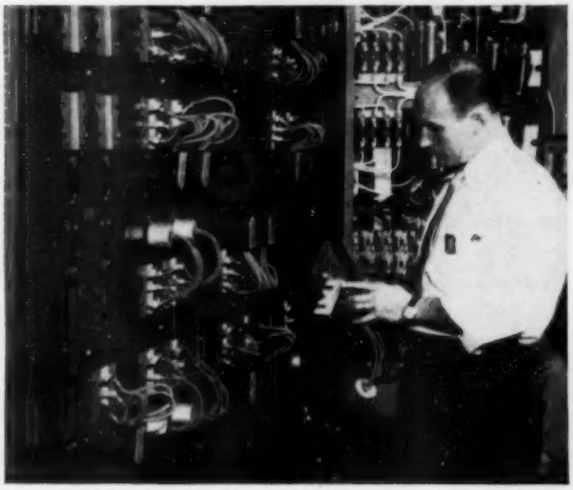

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QUESTION BOX

readers' questions of general interest

Q. 162. We are experiencing considerable difficulty in the anodic treatment of small parts, such as small washers and rivets. We have tried several sizes and designs of baskets, but only a small percentage of the load is acceptable. Can you offer any advice or suggestions for the treatment of such parts to produce a uniform coating without individually racking each piece?

A. (It is assumed that the anodic treatment refers to the anodizing of aluminum parts.) It is essentially impossible to produce a uniform coating in baskets because of overlapping and multiple contact points. However, practical results are obtained by using small diameter baskets. A perforated aluminum cylinder approximately three inches in diameter and 24 inches long, equipped with a pressure-plate top to hold the parts in tight contact, has been used to produce practical coatings. Rivets should be mixed with washers to prevent as much overlapping as possible. The finished load may be speedily separated by screening. It must be remembered that the anodic film will be thinnest in the contact area. Generally this condition is accepted by industry.—E. L. Combs.

Q. 163. We want to know whether there is a documentation on the fabrication and use of electrolytically galvanized sheet steel which is named "Paint Grip". Could you tell us the names and addresses of producers of this material?

A. To receive further information on "Paint Grip" it is suggested that the Armco Steel Corporation at Middletown, Ohio be contacted.—Stuart J. Swensson, Jr.

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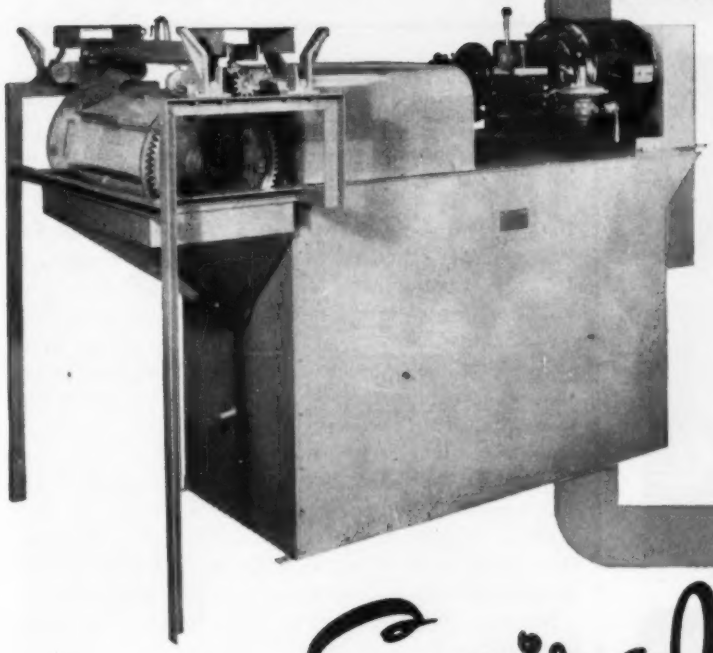

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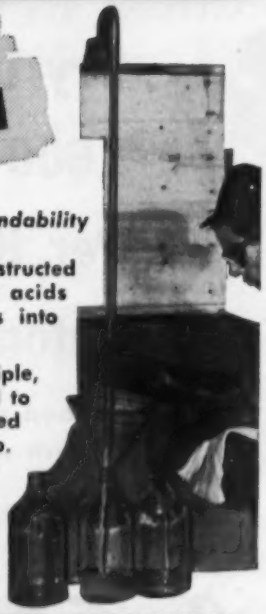

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Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

Bright Metal Surfaces and a Theory of Bright Plating. T. P. Hoar. Trans. Inst. Met. Finishing, 1953, **29**, Advance copy No. 11.

The nature of bright metal surfaces and the methods available for their production are discussed. It is shown that the production of a bright surface (other than by mechanical working or by rupture at cleavage planes) involves the deposition or removal of surface atoms in a random manner.

Methods by which random electrodeposition of atoms giving bright plating can be achieved are discussed. A detailed mechanism of the action of addition agents is described, in which it is suggested that two main categories of such agents can be distinguished.

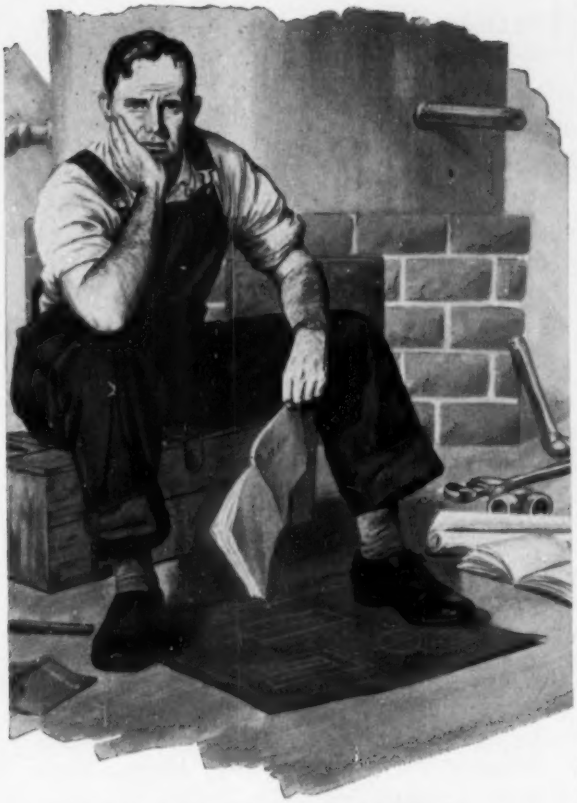
Suggestions for practical advances based on the general theory are made.

Electroplating on Beryllium. John G. Beach and Charles L. Faust, J. Electrochem. Soc. **100**, 6, 276-279 (1953).

Two methods for electroplating on beryllium are discussed; one method involves electrochemical and chemical activation of the beryllium for direct plating with other metals, and the other involves an intermediate replacement zinc film on the beryllium surface. Chemical polishing of beryllium is described. Alloying of the beryllium with the deposited metals and its effect on the as-plated adhesion are also discussed. One figure, 3 references.

Bright Silver Plating. G. Heilmann, Metalloberfläche B53 (April, 1953).

The author discusses 35 publications, including patents, on bright silver plating and anodic polishing of



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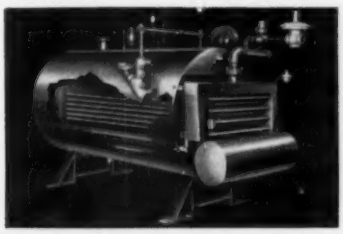

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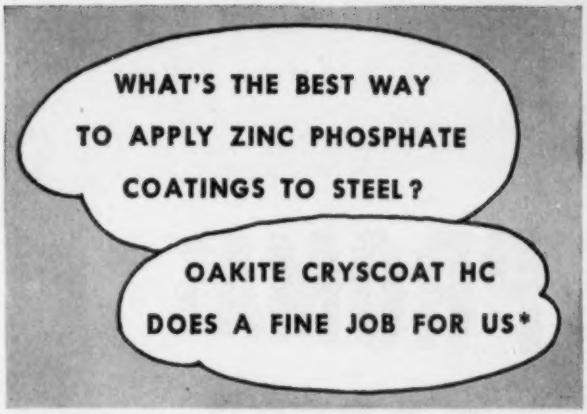

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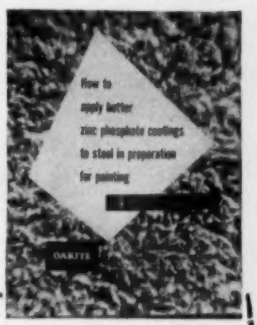

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Article Abstracts

silver. The description of commercial processes is substantially limited to German practice while electropolishing processes described are primarily American.—Otto Kardos.

Electrodeposition of Platinum Metals. H. L. Grube, Metalloberfläche B61 (April, 1953).

The properties of these metals, standard plating solutions and technical applications are described.

Ruthenium, osmium, iridium are not commercially electrodeposited. Where highest corrosion and tarnish resistance are required rhodium or platinum deposits are recommended. Because of lower porosity, better appearance, higher reflectivity as well as higher melting point and electric conductivity rhodium is generally preferred over platinum. The price differential in favor of platinum is not important if prices are referred not to weight but to thickness of electrodeposits.

When lower corrosion and tarnish resistance, hardness, wear resistance and conductivity are satisfactory the much less expensive palladium should be seriously considered over rhodium.—Otto Kardos.

Finishing Systems for Aluminum Die Castings. R. V. Vanden Berg. Precision Metal Molding **11**, pp. 58–67, 88–91 (June, 1953).

A general review article describing several methods of finishing for the various die casting alloys. Comparisons are made between the different types of coatings and the general characteristics of each outlined.

The Production of Printed Patterns by Vacuum Evaporation. E. Kafig. Rev. Sci. Instruments **23**, p. 54 (January, 1952). Vacuum **2**, No. 2, p. 193 (April, 1952).

It is often desirable to produce coatings by the evaporation method in the form of patterns. The authors were asked to manufacture a large quantity of small aluminum strips, rectangular in shape, required for a specific industrial application and, as the conventional method of masking was found too cumbersome, developed the method described in this note. They made an ordinary printers' zinc plate from a negative drawing of a pattern consisting of several hundred of the aluminum strips required. This negative pattern was printed onto sheets of plastic material with printers' ink. Silicon monoxide was rapidly evaporated onto the plastic under a vacuum of 10^{-4} millimeters mercury. Subsequently the aluminum layer was evaporated onto the sheet and, finally, a second silicon monoxide film for the purpose of protection. After completion of the evaporation the sheet was submerged in a solution of white gasoline with 10 per cent carbon tetrachloride. As a result the multiple layer film could be wiped off from the inked areas without difficulty, leaving the positive pattern in aluminum.

Patent Abstracts

GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D. C. Price 25 cents each.

No. 2,640,021, May 26, 1953—Composition and Process for Chromium Plating—F. Passal, Assignor to United Chromium, Incorporated.

According to the present invention, an aqueous chromium plating bath (and a composition for making up such a bath) is provided, which has a catalyst acid radical content supplied from strontium sulfate and potassium silicofluoride, these two compounds being present in excess of their solubilities in the bath, and which has a wide range of chromic acid concentrations, said bath giving superior performance and being self-regulating as to the catalyst acid radical content in solution.

EXAMPLE I		*Parts by Weight*
CrO_3	97.7 per cent	100.00
$SrSO_4$	0.6 per cent	0.61
K_2SiF_6	1.7 per cent	1.74

EXAMPLE II		
CrO_3	95.3 per cent	100.00
SrO_4	1.4 per cent	1.47
K_2SiF_6	3.3 per cent	3.5

EXAMPLE III		
CrO_3	90.1 per cent	100.00
$SrSO_4$	2.7 per cent	3.0
K_2SiF_6	7.2 per cent	8.0

EXAMPLE IV		
CrO_3	92.5 per cent	100.00
$SrSO_4$	2.0 per cent	2.16
K_2SiF_6	5.5 per cent	5.95

CLAIM 14. A composition of matter for making up and maintaining an aqueous chromium plating bath comprising essentially chromic acid: (1) a bath-soluble compound containing catalytic sulfate radical; (2) a bath-soluble strontium compound of a non-catalytic anion, the amount of said strontium compound being stoichiometrically equivalent to the amount of said sulfate compound so as to react therewith in said bath to form strontium sulfate; (3) a bath-soluble compound containing catalytic silicofluoride radical and (4) a bath-soluble potassium compound of a non-catalytic anion, the amount of said potassium compound being stoichiometrically equivalent to amount of said silicofluoride compound so as to react therewith in said bath to form potassium silicofluoride, the said four compounds being present in such quantities to form at least about 0.61 part by weight strontium

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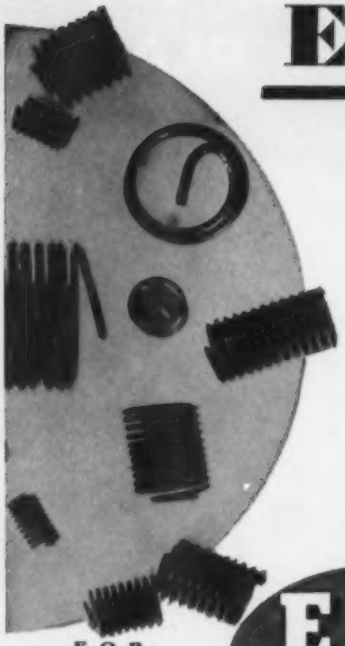

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sulfate to 100 parts by weight of chromic acid and at least about 1.74 parts by weight of potassium silicofluoride to 100 parts by weight of chromic acid, said composition when dissolved in water to produce a solution having 200 to 500 g/l of chromic acid dissolved therein, also producing in such solution dissolved amounts of strontium sulfate and potassium silicofluoride sufficient to saturate said solution, and also undissolved amounts of strontium sulfate and potassium silicofluoride.

14 claims, 4 examples, 3 figures.

References cited: U. S. Patents 1,815,081; 1,844,751; 1,864,014; 1,928,284; 2,042,611. British Patent 566,218.

No. 2,640,806, June 2, 1953—Process for Polishing Aluminum.—F. H. Hesch, assignor to Kaiser Aluminum and Chemical Corporation.

Chemical brightening of aluminum has previously been accomplished using a combination of nitric and hydrofluoric acid. . . .

The following example of a chemical dip solution producing maximum brightness is illustrative of a specific embodiment, and is not to be construed as a limitation of the invention.

Constituent	Volume Concentration per liter	Per Cent Weight of Solution
HNO_3	50 (70% HNO_3)	5
HF	2 (48% HF)	1
Glycerol	25	3
Water-balance		

A gold strip electrode was electrically connected to the work piece to be brightened during immersion of the latter in solution.

CLAIM 1. A process for chemically brightening of aluminum and aluminum alloys which comprises electrically connecting the work to a noble metal electrode and subjecting the work to the action of an aqueous solution consisting essentially of hydrogen,

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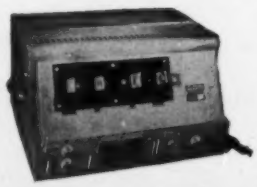

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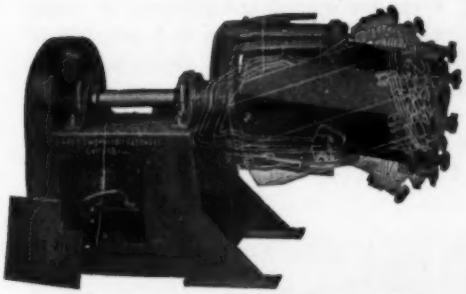

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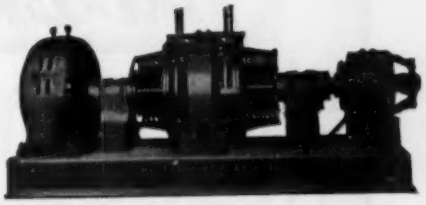

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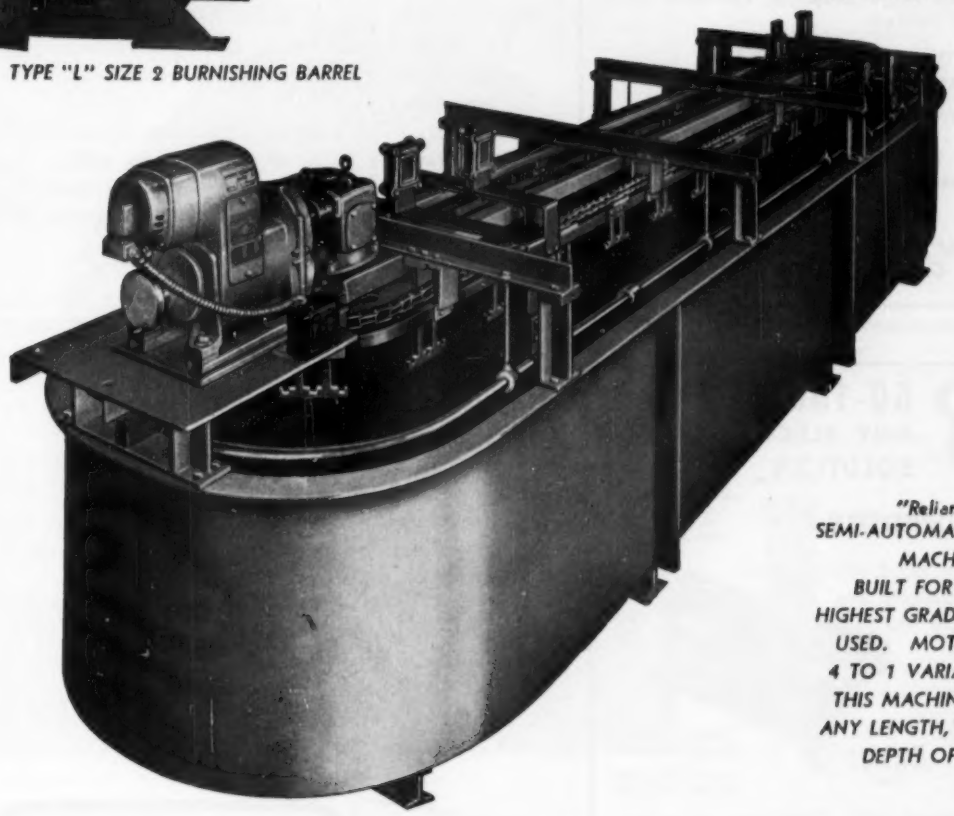

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LSI-10	100 gal./hr	12" x 16" x 16"	40 lb
ASI-300	300 gal./hr	2' x 2' x 2'	125 lb
ASI-400	400 gal./hr	2' x 2' x 2'	135 lb
ASI-600	600 gal./hr	2' x 2' x 2'	150 lb

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Patent Abstracts

nitrate and fluoride ions in concentration corresponding to that produced by a solution containing from about 0.5 to 6 per cent nitric acid, and about 0.01 to 0.5 hydrofluoric acid by weight and maintaining the solution at a temperature of from 100° F to the boiling point.

CLAIM 3. A process according to claim 1 in which the solution contains from about 0.5 to 5 per cent of a lower molecular weight polyhydric aliphatic alcohol as an inhibitor.

7 claims.

References cited: U. S. Patents 2,037,633; 2,052,962; 2,375,394. French Patent 798,721. German Patent 471,053.

No. 2,641,559, June 9, 1953—Method of Cleaning and Descaling Ferrous Articles and Bath Thereof—M. H. Pakkala and F. J. Phillips, Assignors to U. S. Steel Corporation.

CLAIM 1. The process of cleaning ferrous articles which comprises contacting the articles with a fused mixture relatively free from moisture and organic matter consisting essentially of the following composition given in percentage of weight.

	Per cent
Alkali metal nitrate	40–99.9
Alkali metal nitrite	0–60
Alkali metal oxide (containing at least two atoms of oxygen per molecule.)	

CLAIM 6. A cleaning bath for an oxide coated ferrous metal article which consists essentially of a fused mixture relatively free from moisture and organic matter having substantially the following composition in percentage by weight.

	Per cent
Alkali metal nitrate	40–90.9
Alkali metal nitrite	0–60
Alkali metal oxide (containing at least 2 atoms of oxygen per molecule)	0.1–0.5

6 Claims.

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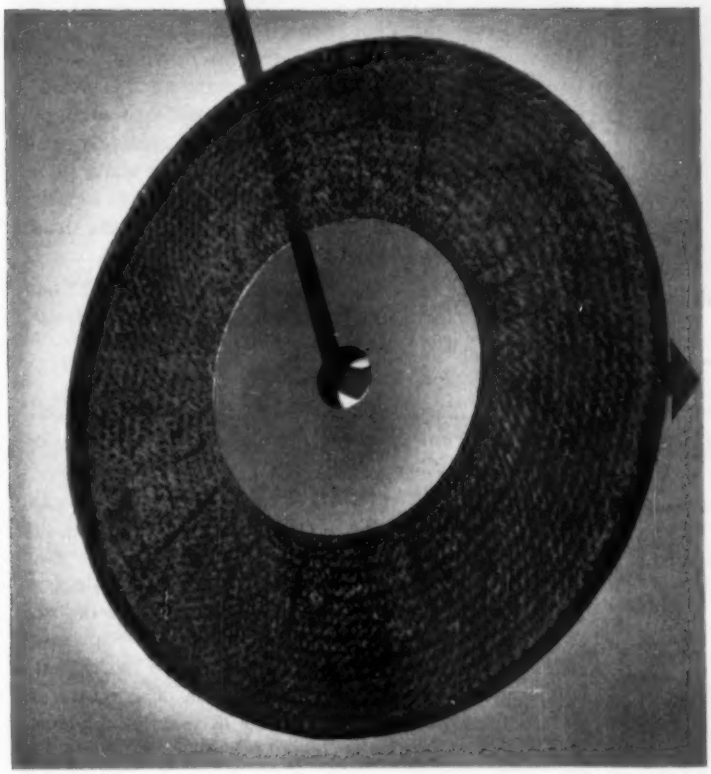

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Patent Abstracts

No. 2,642,392, June 16, 1953—Electroplating Apparatus—C. J. Sommers, Assignor to Sommers Bros. Manufacturing Co., St. Louis, Mo.

CLAIM. In an electroplating device, a tank for an electrolytic solution, a drum for articles to be electroplated, an integral U-shaped frame mounted transversely of the tank, the outer ends of the arms of said U-shaped frame having axially aligned horizontal pintles, said drum having its ends rotatably mounted on said pintles, a pintle carried by one of said frame arms intermediate its ends, said last named pintle be rotatably mounted in a bearing carried by one side of the tank, means cooperating with said last named pintle for pivotally rocking said frame, a drive shaft journalled on the tank opposite the last named pintle in axial alignment therewith, the other arm of said frame being rockably mounted intermediate its ends on the drive shaft in a bearing opening passing through said last named arm, whereby said drum is arcuately movable downwardly into the tank and upwardly out of the tank, and a gear carried by the drive shaft to the inner side of the last named arm, said gear meshing with a gear carried by the adjacent end of the drum.

1 claim, 6 figures.

References cited: U. S. Patents 679,357; 1,135,660; 1,505,424; 1,695,795; 2,035,633; 2,315,272. Italian Patent 277,032.

No. 2,643,222, June 23, 1953—Method of Cathodically Descaling and Electrode Therefor—G. C. Cox, Charleston, W. Va.

CLAIM 16. The method of cathodically descaling the surface of iron or steel structures at a current density in excess of 25 amperes per square foot which comprises the steps of: holding one side of a thin flexible nonconducting porous electrode separator against the surface of the structure under treatment by pressing against the separator with the sides of a multiplicity of slender substantially parallel rods of a metal selected from the group consisting of magnesium, mag-

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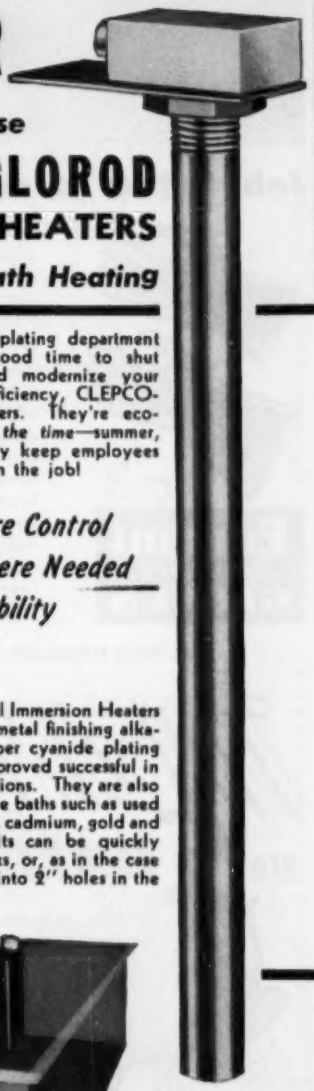

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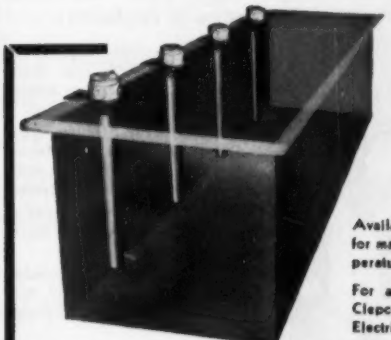

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Patent Abstracts

nesium base alloys, aluminum or aluminum base alloys; flexibly connecting the rods to the said structure through means for generating an additive polarity low voltage direct current supplementing the galvanic potential; then repeatedly filling the voids between rods and the co-acting surface of the structure with an electrolyte consisting substantially of sea water and for a sufficient time to descale the surface.

16 claims, 8 figures.

References cited: U. S. Patents 626,972; 872,878; 1,017,671; 1,430,844; 1,629,212; 1,721,949; 2,215,102; 2,435,986; 2,444,174; 2,451,066; 2,540,602. British Patents: 996; 3,136; 15,264; 15,383; 335,151.

No. 2,643,223, June 23, 1953—Apparatus for Electrolytic Analysis—R. W. Nolvest, assignor to American Brake Shoe Company, New York, N. Y.

CLAIM 1. In an electrolytic apparatus for quantitative determination of solutions, an electrode unit comprising, a substantially cylindrical platinum gauze electrode adapted to be immersed in the solution, the bottom of said gauze electrode being closed by a convexly rounded and imperforate closure member provided at its bottom center with a passage extending therethrough to open into the interior of said cylindrical electrode, and a hollow tubular current-conducting element extending longitudinally of and substantially centrally in the said gauze electrode, one end portion of the tubular element being adapted to be connected to a source of CO_2 gas, the other end portion of the tubular element being sealably positioned in said passage whereby CO_2 gas conducted through said tubular element will bubble upwardly along the outer sides of the closure member to clean adherent oxidizing gases from outer sides of the gauze electrode during electrolysis.

3 claims, 5 figures.

References cited: Transactions—The Electrochemical Society, Vol. 76 (1939), pp. 63–68. Zeitschrift fur Elektrochemie, Vol. 17 (1911), pp. 905, 906.

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A.E.S. News

New Executive Secretary

P. Peter Kovatis of Hartford, Conn., was named to the post of Executive Secretary by the A. E. S. Executive Board according to an announcement made by President George P. Swift. The new

Kovatis

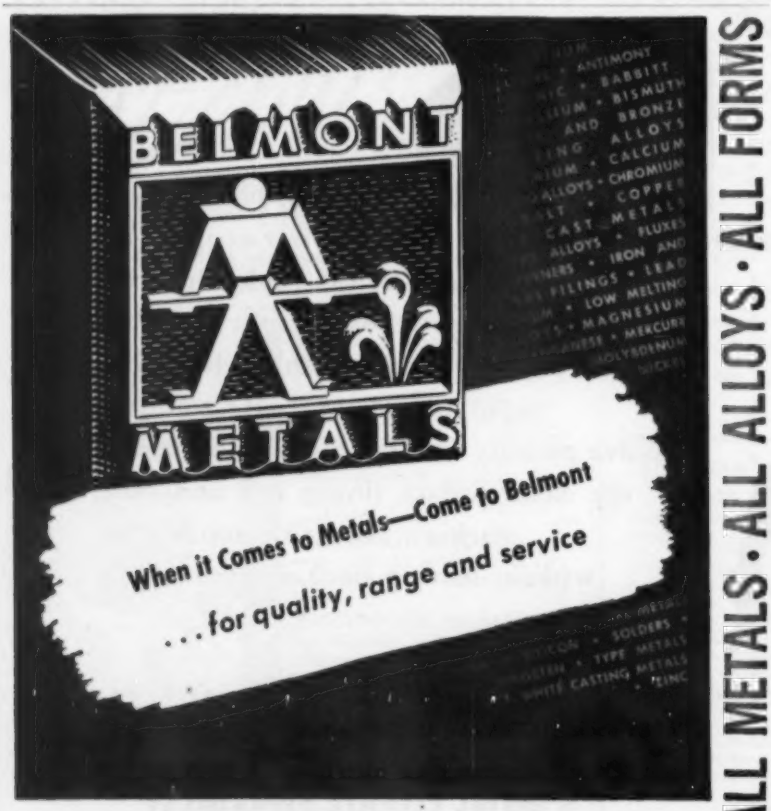
Foulke

Executive Secretary assumed his new duties on August 1 and came to the A. E. S. with more than 10 years' experience in the public relations and administrative fields. For the last two years he was Public Relations Director and Director of Membership promotion at one of the East Coast's largest non-profit institutions in Hartford where he was cited recently for achieving "one of the best records in a decade".

He is a graduate of Boston University at which institution he matriculated in the College of Business Administration and School of Public Relations and Communications. He holds a Bachelor of Science degree in Public Relations.

A World War II veteran with two years' service in Field Artillery and almost three years in the Air Force, Kovatis rose from private to Captain. He was Executive Officer, Personnel Officer, Adjutant, Trial Judge Advocate, Unit Historian, Public Relations Officer and Statistical Officer. He served with the 14th Air Force "Flying Tigers" in China and holds commendations for "directing the most efficient administrative units in the China Theater".

Dr. D. Gardner Foulke, who resigned as Executive Secretary to take over his new duties as Manager of Electrochemical Development for the Hanson-Van Winkle-Munning Company, will be in charge of the laboratory phase of research in electroplating and metal finishing there. Prior to serving as Executive Secretary of the Society, Don Foulke was Chief Chemist for H-VW-M. He is a graduate of Juniata College and Rutgers University. Before his connection with the metal finishing industry he had a varied experience in organic research, steel technology, general chemical consulting work and university teaching.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Branch News

BOSTON BRANCH

On June 4, a meeting was held in the Hotel Statler. Speaker for the evening was Alan R. Burman, Vice-President, Cro-Plate Co., Inc., Hartford, Conn. His subject was "Wet Blasting".

Burman presented a timely and interesting talk. Preparation of parts for chromium plating direct on aluminum, cleaning of cutting tools, deburring of intricate shapes, cleaning the inside of long internal holes in work of various types as well as the safe, efficient and economical removal of heat treating scale are but a few of the points brought out in the paper. Actual specimens were shown at the meeting.

George P. Swift, *Secretary*

CINCINNATI BRANCH

The May 27 meeting opened with 33 men present and Carl F. Truman presiding.

A motion was approved that the Dayton, Louisville, Columbus and Indianapolis Branches be consulted on the possibility of having a regional Annual Education Session and Dinner-Dance. President Truman instructed Mr. Loveless to write the various branches inviting them to a meeting to discuss the regional affair.

He also instructed the Secretary to write Charles Wise, the retiring secretary, a letter of thanks for a job well done.

Charles L. Wallace made application and was accepted as a student member.

Ezra A. Blount, the Editor of Products Finishing, was introduced as the speaker of the evening. Blount gave a very informative and interesting talk on conditions in Japan, illustrated by color movies he had taken during his recent stay there.

The meeting was followed by a social hour sponsored by the Gil-Ron Products Company of Cleveland.

William Young, *Secretary*

CLEVELAND BRANCH

The following is a list of the new Branch officers installed at the May 1, 1953 meeting:

President—Jack Little
First Vice-President—Henry Friedberg
Second Vice-President—Justin Emlich
Secretary-Treasurer—Bert Lupien
Librarian—Ed Roehl
Assistant Librarian—Arthur DuRose
Board of Managers—Harry Pochapsky

A. J. Lupien, *Secretary-Treasurer*

GRAND RAPIDS BRANCH

The May meeting was held at the University Club on the 8th with approxi-

mately 90 members and guests attending. The dinner menu of either steaks, fish or shrimp was enjoyed by all.

PRESIDENT KEITH YHOUSE read a report on membership status for the past fiscal year. Membership now stands at 174 with a net gain of 16 or 9.2 per cent.

Delegates and alternates elected to the National Convention were: JACK HANNEY MAURIE CALDWELL, DON SCHANTZ, BILL ERSKINE, JOE HAVILAND and JIM BADALUCO.

A proposal and motion was made by LYMAN SPERRY that the Grand Rapids Branch sponsor a Bronze Medal for the third place paper at the annual convention in place of the present certificate award. The motion was seconded and carried unanimously. This medal will be known as the "Grand Rapids Bronze Medal".

It was with complete pleasure that Keith Yhouse presented the "Past Presidents" pins to all such members at the meeting. Jack Hanney, Don Schantz, STEVE COWDERY, Lyman Sperry, F. D. PACE, Jim Badaluco, Maurie Caldwell and HAROLD GRUTTER were recipients of such awards. Others mentioned but not present were HARMER MORTON, CHARLIE WERFT and C. M. FERNEKES, who will receive their pins by mail.

Mention was made of the fact that meetings would again be held at Fingers Restaurant during the coming year.

The meeting was then turned over to Lyman Sperry, who introduced the board of metal finishing experts for the evening. They were BOB DUDLEY, United Chromium, Inc.; BEN SCHOTTEN, Northwest Chemical Co.; LEE M. MORSE, Chrysler Corporation; WAYNE FULLER, Grand Rapids Varnish Corp.; ROBERT MEECH, American Chemical Paint Co.

A very interesting and lively discussion followed.

After the adjournment of the meeting many stayed to enjoy refreshments by courtesy of "DUSTY" RHOADES of the Northwest Chemical Company.

JOHN DYKSTRA, *Secretary*
BERNARD JULIEN, *Publicity Chairman*

HARTFORD BRANCH

The last meeting of the season was termed the Past Presidents' Night and the usual educational program was dispensed with. About 87 members and guests were present at the Nutmegger House in Newington to do honor to 15 past presidents.

After partaking of an excellent roast beef dinner, the meeting was turned over to ART LOGOZZO who was the master of ceremonies for the evening. Each of the 15 past presidents were briefly introduced by Mr. Logozzo and were called upon to relate a humorous anecdote in their plating experience. This was then followed by the presentation of Past Presidents' pins to the group being honored.

STANLEY PLATOZ, *Secretary*

LOS ANGELES BRANCH

A very informative talk on "The Physical and Mechanical Properties of Nickel Electrodeposits", was given by DR. VICTOR ZENTNER, of Surface Alloys, Inc., and also a member of Los Angeles Branch.

Dr. Zentner's talk related more to the theoretical aspects of nickel electrodeposition.

In his talk he stated that the presence of oxygen and hydrogen in the deposits are about the same proportions as in water.

On the basis of measurements he added that he believes that the most important factor in shaping the structure and the properties of nickel deposits is the oxygen content which in turn indicates the amount of basic nonmetallic inclusion in the deposit.

There is considerable amount of carbon and sulfur present in deposits of bright nickel, which originates from the sulfonated compounds and wetting agents usually present in these baths.

Dr. Zentner believes that the basic theory which he has drawn from his observations, namely, that the composition of the deposit with the attendant structural changes is primarily responsible for the large variation in physical and mechanical properties, will be valid for nickel and for any metallic electrodeposits.

Following the talk, a question and answer period was held and the meeting was adjourned at 10:00 P. M. by PRESIDENT JOHN MILLHORN.

L. TRUMAN STONER, *Secretary*

MELBOURNE BRANCH

On May 18 at Hotel Federal, Melbourne, the Branch opened its three-day 1953 Australian Federal Convention, under the Chairman, BRANCH PRESIDENT GLEN WALKER.

An excellent attendance of 150 members and delegates included DR. WILLIAM BLUM of U. S. A. and 30 members from Interstate Branches, proving the popularity of the Convention, and at the same time, reflecting the significance of electroplating in this country.

In the three technical sessions, eleven papers were presented, including two addresses by Dr. Blum—"Latest Trends in Electroplating Practice" and "Electroplating and A. E. S. Research". Interesting discussion periods followed.

Two plant visits—Overhaul Workshops, Trans Australia Airlines, Essendon, and General Motors-Holden Plants were attended by 130 delegates.

Display boards were submitted by 20 Australian firms, and to the firm submitting the most interesting board (Messrs. K. G. Luke (Aust.) Ltd.) an "Oscar" was presented by Dr. Blum.

To culminate the Convention, a dinner-dance was held in the Regent Room of Hotel Federal on Wednesday, May 20, where 160 delegates and partners dined and danced.

"Proceedings" of the Convention are being published and will be available to all A. E. S. members and platers in general, to ensure that they will have a full report on the Convention.

The 78th regular meeting was held on June 18 at Melbourne Technical College, with President G. Walker and 40 members and visitors present.

After the acceptance of 5 new members, the speaker for the evening, MR. H. LITTAUER, was introduced by LIBRARIAN H. TEAGUE.

Mr. Littauer's subject, "Aspects of Anodising of Aluminum", was opened with an explanation of the basic principles of anodising and practice of same. To form an even anodic film, much depends on the purity of the metal, silicon impurities causing pitting.

An interesting demonstration was given on the dyeing of aluminum, results depending on immersion time, temperature and peculiarities of the film.

After questions put to speaker by members, MR. DALE thanked Mr. Littauer for his most informative address.

The President announced that our most esteemed member, R. TAYLOR, was spending his last evening with the group before departing for Brisbane, Queensland to take up an important post. The President thanked Bob Taylor for all he had done for the Branch in the past, especially his 18 months as President, and for his activities as a committee man.

All sub-committees and branch members were thanked for their support at the recent Australian Federal Convention, on which excellent reports had been received from all who attended.

Dr. William Blum's Australian tour has been an uplift to the A. E. S. and the electroplating industry, and did much to cement a further bond of friendship between the two countries.

S. B. PEARCE, *Secretary-Treasurer*

MILWAUKEE BRANCH

Officers elected for 1953–1954 are:
President—FRED ANDERSON
First Vice-President—ALVIN SCHMIDT
Second Vice-President—RAY GOODSELL
Past President—KENNETH OLSEN
Librarian—JOHN SCHNEIDER
Secretary-Treasurer—GENE PIELLUSCH
Board of Managers—EVERETT ROBINSON, VINCENT MATTACOTTI, LESLIE DIVELEY

A feature of the June 5th regular meeting at the Ambassador Hotel was the Past Presidents' Dinner to honor all past presidents of the Branch. It was a gala and festive occasion, complete with cocktails and entertainment. All past presidents were awarded a pin in recognition of their services to the Branch. Following the dinner the new officers were installed.

GENE PIELLUSCH,
Secretary-Treasurer

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ASSIST—your branch Research Chairman in his efforts to obtain additional Sustaining Memberships.

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Branch News

MONTREAL BRANCH

The January meeting was held in the Mount Royal Hotel on the 13th, when DR. H. L. KELLNER of the Lea Manufacturing Company, Waterbury, Conn., and MR. E. OSTROW of the Ronal Chemicals, Inc., Long Island, N. Y., were guest speakers.

Kellner spoke on the advantages of a Bright Copper Solution and compared the finish obtained to that of bright nickel. Ostrow spoke on Bright Silver Plating, and mentioned in his talk that the brightest deposits obtained in silver plating today are those where a sodium bath is in use.

The following applicants were elected to membership: H. ROACH, MacDonald Metals and Plastics, Waterloo, Que.; G. R. HASTINGS, The Griswold Company, Montreal, Que.

At the February meeting JOSEPH GURSKI, Head of the Materials and Process Sections for the Ford Motor Company of Dearborn, Mich., was the guest speaker. Gurski chose as his topic, "Plating Applications to Automotive Parts". In his talk he mentioned that cadmium plating was used extensively on certain metals as a means of imparting resistance to corrosion. Also mentioned was that one of the most important factors is cleaning, not only for plating but also where a part or surface was to be painted.

The following applicants were elected to membership: VICTOR HOLLY, RCA Victor Company, Ltd.; LOUIS POIRIER, and B. LAFOND, both of Alloycraft, Ltd.

A favorable report was read by JOHN T. REISENBURG, SR., regarding the convention for Montreal. A final vote, when taken, was in favor of the convention being held in Montreal in either 1957 or 1958.

At the March meeting the guest speaker of the evening was A. C. WEST, Assistant General Manager of the Canadian Hanson Van Winkle Co., Ltd. of Toronto, Ontario. Topic of the evening was "The Use of Anodes in Electroplating". Mr. West, through the use of several samples of used anodes he had brought with him, was able to illustrate what effects could be obtained through the use of anodes that were of improper length. He mentioned that an electrolytic copper anode should be completely immersed so that the maximum amount of metal could be taken from the anode.

During the business session that followed a letter from Headquarters was read to the members present that the dues were to be raised from eight dollars per year to nine dollars.

A ballot was taken and elections were held for the slate of officers to take office for the 1953–1954 term. Incoming officers for the new year were installed by John T. Reisenburg, Sr. The retiring slate of officers were thanked for their splendid work during their term of office.

Those elected are:

President—J. J. ROCHE
First Vice-President—WM. FEELEY
Second Vice-President—J. P. COURTEMANCHE
Third Vice-President—J. CARRIERE
Secretary—JOHN T. REISENBURG, JR.
Librarian—RALPH COHEN
Board of Managers—R. E. GORDON, Chairman; JOHN T. REISENBURG, J. D. FAIRBAIRN, P. M. COADY, R. DAVIDSON

JOHN T. REISENBURG, *Secretary*

NEWARK BRANCH

A regular meeting was held on May 15, at the Robert Treat Hotel.

Application for membership by JOSEPH SCHMERIN was voted to take the regular course.

The following men were elected to membership: JULIUS ZIMMERMAN, CHARLES MEFFLEY, JR., JAMES NODDINGS, EDMUND HANLON, EUGENE GWYER, and MERRITT J. WARWICK.

A resignation was received from MARTIN KAPLAN and accepted.

M. B. DIGGIN was elected chairman of the 1963 Convention.

LIBRARIAN TOM AUSTIN introduced the speaker for the evening, M. S. CHAMBERLIN of the Technical Service Division of the Wallace and Tiernan Co., Inc. His subject was "Reduction of Toxic Chromium Wastes and Cyanide Waste Treatment". Industrial wastes are a big problem the speaker noted and continued that progress has been slow because of the diversity and complexity of the wastes requiring corrective treatment. The alkaline chlorination method for treatment of cyanide wastes was explained. The method of reduction of the hexavalent chromium with sulfur dioxide or alkaline salts, and sulfites was stated as one that is widely accepted in the industry as a practical means of disposal. Mr. Chamberlin, with the help of slides, illustrated the different processes.

GEORGE REUTER, *Recording Secretary*

George Wagner of the Newark Branch being presented with a gold and silver plated pot by Ken Huston at the Newark Branch Picnic

PROVIDENCE-ATTLEBORO BRANCH

A special Branch meeting was held in Dr. Parker's office, on May 11. All officers and past presidents were present and plans for the 1953–1954 season were formulated.

The regular Branch meeting was held in the Providence Engineering Hall on May 18 with GEORGE GIBBS presiding.

Guest speaker for the evening was GEORGE FRANKOVICH, Executive Secretary of the New England Jewelers and Silversmiths Association, who chose as his subject, "Developments in the Electroplating Field".

His talk was divided into two parts: (1) Training of Employees in the Jewelry Industry; (2) Stampings and Markings in Electroplated Jewelry.

A committee composed of CHAIRMAN JOSEPH SMITH, DR. EDWARD PARKER and MR. ERIC SHEARSTONE was formed to help Mr. Frankovich who is representing the industry before the Federal Trade Commission which is trying to set minimum standards for the jewelry and silver industry.

HENRY SHAVIER, *Secretary*

ROCHESTER BRANCH

The May meeting of the Branch, the final session of the 1952–1953 season, was a dinner meeting at the 40 & 8 Club. Forty-two members enjoyed a delicious roast beef dinner complete with all the trimmings, courtesy of the local suppliers. Following the dinner the group was honored to have as guest speaker, DR. D. GARDNER FOULKE, the Society's Executive Secretary. Dr. Foulke spoke generally on items regarding the Society, its history, aims, future plans, etc. An informal discussion on further matters of Society policy followed which also proved interesting and informative.

E. WALLIN, *Secretary*

SAN FRANCISCO BRANCH

A meeting was called to order by the Branch's new president, STUART PANKEY, on April 16. A number of letters were read to the members, also a notice of the increase of dues to the annual rate of $10.00.

MR. PATTENGER of the Board of Managers criticized the lack of business-like attitudes of the branch officers and suggested that the dues bills be sent out one month after the secretary takes office and that a complete audit of the books be made. A general discussion of these statements was held by the membership and it was agreed that any member 60 days in arrears would be dropped and that the bills would be sent as soon as practicable. The Secretary then stated that the books would be in order for the inspection by the Board of Managers at their earliest convenience.

The meeting was then turned over to HORACE SMITH, who gave a dissertation on "*p*H Control of Sealing Solutions After Anodizing".

The following two members were elected to membership: FLOYD W. BROWNING and WILLIAM T. MACFARLANE.

The meeting was adjourned at 12 P.M.

HORACE J. SMITH,
Secretary-Treasurer

SOUTHEASTERN BRANCH

At the meeting held at Belmont Steak House on April 10 the following officers for 1953–1954 were elected and thereafter installed:

President—CYRUS N. SHEARER
First Vice-President—RAY C. STEFFY
Second Vice-President—CLYDE STOVALL
Librarian—DAVE HOLLAND
Secretary-Treasurer—C. A. COLLINGS
Board of Managers—M. E. AWTREY, W. T. WEYMOUTH, E. J. SLEMONS

CHARLES ANGER reported that Branch delegates to the National Convention must be instructed if the Branch wishes to have a National Convention in Atlanta. There was a general discussion as to advisability, costs and advances of a convention. It was decided to hold over until May meeting for final decision.

The May 9th meeting was held at Belmont Steak House and was called to order by President Cyrus Shearer at 7:45 P. M. with 18 members present.

Two delegates and four alternates to the Convention were appointed as follows:

Delegates: RAY CHAS. STEFFEY, BOB TAYLOR
Alternates—M. E. AWTREY, H. B. STOGNER, W. T. WEYMOUTH, CYRUS N. SHEARER

Dave Holland introduced the speaker of the evening, W. B. WEIR, Director of Water Pollution Control, Georgia Department of Public Health, whose subject was informally presented, followed by a question and answer period on "Stream Pollution Control as a Practical Matter with Electroplaters".

CHAS. A. COLLINGS,
Secretary-Treasurer

(*Continued on page 934*)

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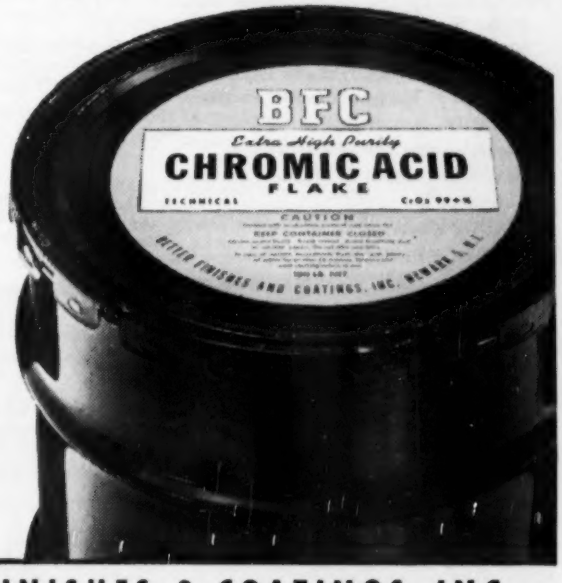

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Membership Report of the A. E. S.

Elections

BALTIMORE: Richard A. Abercrombie, Charles W. Bridge, Elmer Leroy Gabel, Jr., David H. Kinder, Benjamin P. McKnew, Edward E. Oberland, Walter E. Pocock

BUFFALO: Raymond E. Blechinger

CHICAGO: John C. Duke, Jerome Kuderna, Jack B. Leichti, Christopher Marzano, Daniel A. Zarlenga

CINCINNATI: Charles L. Wallace

CLEVELAND: George Chimples, Kermit L. Eubanks, Thomas E. Lamp, Charles E. Meldrum, Arnold E. Pavlish, Richard F. Roy, Alvin E. Seely, George Walton

DAYTON: Martin A. O'Loughlin

LOS ANGELES: Warren G. Blazer, George R. Bouffard, Alfred E. Clenard, David J. Colyer, Jr., Ford Cowing, Norman Dieball, George W. Duncan, Ira Edwards, Norris Freeman, Willard C. Heinecke, Irvin E. Kort, Glenn O. Mallory, Jr., Leo Missel, Richard S. Patterson, Charles A. Petre, Harry J. Reading, Ralph G. Skaggs

MONTREAL: G. R. Hastings, J. Benjamin Lafond, Victor Holly, Louis Poirier, Harold J. Roach

NEW YORK: Frederick Bernier, Peter Catalanotto, Jose A. Clavell, Peter J. Hoffman, Samuel Hurewitz, Charles Kanigel, Ralph E. Kwarsick, Sidney Lieber, Rudy Pellmar, William E. Petrie, Gus Prestifilippo, Frank Puma, John K. Shaw, Morraine E. Stangl, George Tanz

PHILADELPHIA: Ernest Arsenault, James E. Goodridge, Richard D. Kerwin, Nicholas J. Maile

SAGINAW VALLEY: Jack Ekleberry, Harrison F. Hooker, Alton R. Jenson

ST. LOUIS: Robert H. Bobilin, Perry L. Higginbotham, Richard E. Loupee

SYRACUSE: Alfred M. Hoehn, Stanley Kozien

TOLEDO: Stanley J. Ignatowski

WATERBURY: Rutledge B. Parker

WICHITA: Wilbur E. Avery, Fred G. Manners, Jr., Forest E. Michael

MEMBER-AT-LARGE: Everett F. Carter, Towanda, Pa.; Paul D. Morrisset, Paris, France; Dr. H. J. Strauss, Elkins Park, Pa.

Reinstatements

CHICAGO: L. R. Gallas, John Kronsbein

Transfers

E. H. McCoy to Milwaukee from Chicago; L. A. Critchfield from Dayton to

Membership Competition

BRANCH	Membership Apr. 1, 1953*	New Members	Net Change Membership	Per Cent Net Change
First Group				
Los Angeles	236	22	+15½	+ 6.6
Cleveland	236	8	+8	+ 3.4
Newark	251	7	+ 6½	+ 2.6
Philadelphia	198	10	+ 5	+ 2.5
Milwaukee	164	4	+ 4	+ 2.4
Detroit	504	11	+ 8½	+ 1.7
New York†	352	15	+ 5½	+ 1.6
Chicago	477	8	+ 6	+ 1.3
Toronto	146	2	+ 1	+ 0.7
Waterbury	130	5	0	0
Boston	155	..	.....	.....
Bridgeport	158	..	.....	.....
Pittsburgh	142	..	− ½	− 0.4
Grand Rapids	173	..	− 1	− 0.6
Melbourne	169	4	− 1	− 0.6
Hartford	151	3	− 3½	− 2.3
Second Group				
Baltimore-Washington	93	7	+ 5½	+ 7.9
Montreal	80	5	+ 5	+ 6.3
San Francisco	74	8	+ 4	+ 5.4
Dayton	76	6	+ 3½	+ 4.6
Rochester	107	4	+ 2½	+ 2.3
Saginaw Valley‡	103	5	+ 2	+ 1.9
St. Joseph Valley	78	2	+ 1	+ 1.3
Twin City	71	1	0	0
St. Louis	109	3	0	0
Bufialo	106	1	− 1	− 0.9
Indianapolis	105	..	− 1	− 1.0
Providence-Attleboro	95	..	− 1	− 1.1
Cincinnati	92	2	− 4½	− 4.9
New Haven	100	..	− 5½	− 5.5
Syracuse	128	2	− 9	− 7.0
Sydney	82	..	−10	−12.2
Third Group				
Springfield	57	7	+ 7	+12.3
Wichita	41	3	+ 3	+ 7.3
Rockford	63	2	+ 2	+ 3.2
Adelaide	52	1	+ 1	+ 1.9
Columbus	52	1	+ ½	+ 1.0
Southeastern	50	2	0	0
Dallas-Fort Worth	53	..	.....	.....
Hamilton	25	..	.....	.....
Houston	42	..	.....	.....
Jackson-Lansing	61	..	.....	.....
Lancaster	69	..	.....	.....
Louisville§	44	..	.....	.....
Western Ontario	22	..	.....	.....
Toledo	56	1	− 1	− 1.8
Kansas City	46	2	− 2	− 4.3
Allentown-Reading	53	..	− 4	− 7.5
Outside Competition				
Portland	....	18	.....	.....
At Large	138	8	+ 7	.....
Total A. E. S.	6,065	190	+77	+ 1.1

Active Membership, June 30, 1953 6,174

*Subject to correction. †‡§Winners in first, second and third groups, respectively, of 1952–1953 membership competition.

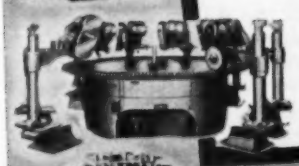
The ACME HORIZONTAL RETURN TYPE *STRAIGHTLINE*

....a versatile automatic Polishing and Buffing Machine easily adaptable to a wide variety of work . . .

The overhead view shown is an ACME 60-ft. Horizontal Return Type Straightline equipped with 16 ACME Type G-3 heavy duty adjustable floating head polishing and buffing lathes and universal indexing fixtures and adapters. It is used for nickel buffing toaster bodies. This type straight line is available in various lengths from 20 feet to 60 feet or more. A 10 ft. drive section and a 10 ft. chain take up section comprise the basic 20 ft. machine which will handle 4 buffing heads. Length is easily increased by adding interchangeable 10 foot sections each allowing room for 4 additional polishing and buffing heads.

CATALOG ON REQUEST

524-65



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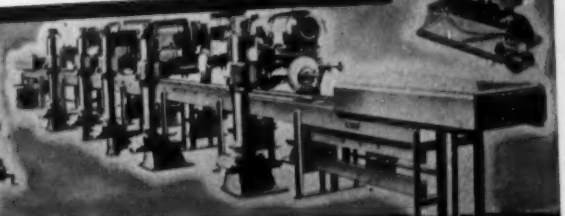
ACME *Automatics point the way to finishing at Low Cost . . .*

ACME Automatic polishing and buffing machines have put finishing operations on a low cost, high production basis in many industries . . . for many years. Progressive experience and specialized attention to the solution of production finishing problems gives this organization unique qualifications to serve you. ACME Automatics have fully proved their performance on such operations as radius blending, armor plate grinding, thread clearing and automatic indexing of many operations, in addition to automatic polishing and buffing of all sizes and shapes of parts.

For recommendations, send blue prints of part or samples before and after finishing, together with detailed information on finishing operations and production requirements. If production methods will cut your costs, we can set your job up in our experimental processing department and you can inspect the machines in operation.



ROTARY STRAIGHT LINE SEMI-AUTOMATIC AND SPECIAL *Polishing and Buffing Machinery*

SPECIAL MACHINERY AUTOMATIC BUFFING MACHINES

ACME *Manufacturing Co.*

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Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

ONLY

Automatic Centerless Buffs

CUT COSTLY CHANGE-OVERS WITH patented "Pre-Assembly"

(U. S. PAT. NO. 2,599,785)

Easy as A·B·C!

A. Lock individual buffs together to build up head of desired width

B. Insert special flanges with "telescoping" *hollow* shafts

C. Press shafts together—*Pre-Assembled* unit is ready to install!

Remove *USED BUFFS* as one unit!
Reload *NEW BUFFS* as one unit!
Change buffs in *SECONDS* . . .
instead of *MINUTES* or *HOURS*!

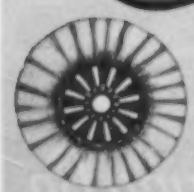
NO OTHER BUFF has the Automatic "PRE-ASSEMBLY" feature—a buff-changing method so unique . . . so superior . . . that it has been granted a patent by the U.S. Patent Office!

Exclusive "LOK-TITE" Ring construction locks buffs firmly together—eliminates costly down-time of one-by-one removal and replacement. Complete heads can be *pre-assembled* in your stockroom—ready for *fast* change-over!

ASK FOR A DEMONSTRATION, IN YOUR OWN SHOP!

WRITE FOR FREE BUFFING CALCULATOR

Ideal for shop foremen. Instantly answers every buffing question — tells what buff to use for any job.



AUTOMATIC BIAS AND SISAL BUFFS

are available with Centerless, Permanent Steel Center or Cardboard centers.

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DIVISION OF

American Buff Company

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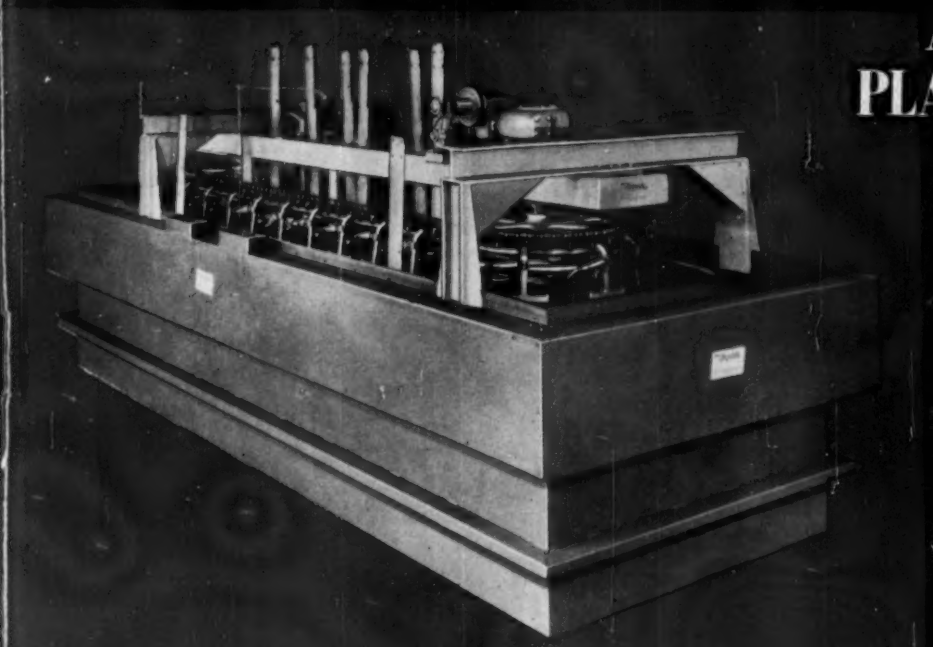
A NEW WAGNER SEMI that grew out of A TOUGH PLATING PROBLEM



Here is a Wagner Semi-Automatic electroplating machine that adds a new high in plating versatility and efficiency of operation. It is provided with heavy duty battery clips for plating the insides of tubes or other hard to reach plating surfaces. This special semi-automatic system, made for a discriminating customer, provides precise control of plate thickness on a specialized group of products with a minimum of attention. You too can benefit from the production know-how of Wagner engineers who constantly search for new and better ways to improve plating processes and equipment which result in lower costs, higher production and a minimum of maintenance.

BEFORE PURCHASING YOUR NEW PLATING SYSTEM . . . CHECK YOUR REQUIREMENTS AGAINST THESE WAGNER FEATURES

1 Simplicity of design and construction

2 Heavy duty battery clips provided for auxiliary contact

3 Anode bar equidistant from hooks, plating through entire cycle

4 Power unit and drive mechanism in one integrated package

5 Variable speed, controlled by one hand knob

6 Standard belt chain, replacements available everywhere

7 Standard fittings provided at all lubrication points

8 Agitating unit mounted on one bracket

9 Fully insulated at all strategic points

10 Double T work carriers shown on 12" centers, may be readily relocated on 16", 20", 24", etc.

11 Completely bussed for easy installation

12 Adjustable draft control

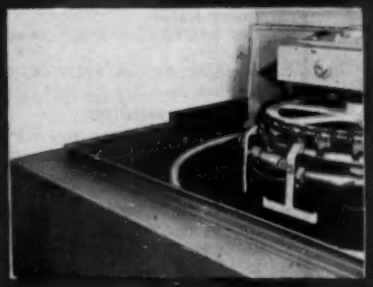
13 Drains for condensation

14 Central stack attachments

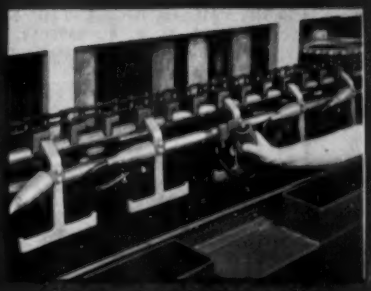
15 Micarta pusher blocks

GREATER PRODUCTION WITH WAGNER SEMI-AUTOMATICS

Wagner Brothers build a complete line of plating equipment job-fitted to your specifications or plant set-up . . . and our modern research facilities and pilot plating plant contains exacting equipment for analyzing your present plating and finishing operations. For full particulars to meet your plating requirements, get in touch with the Wagner representative nearest you, or write direct to us stating your needs.



Adjustable draft box hoods



Heavy duty battery clips

Wagner BROTHERS INC.

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Wagner Brothers, Inc., 425 Midland, Detroit 3, Mich.

- ☐ Send name of representative
- ☐ Send information on Wagner Semi-Automatics
- ☐ Put me on your Price-Tips mailing list

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Company _____

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Available for Immediate Shipment, Attractive Values

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1—7500/3750 AMPERE, 6/12 VOLT, MUNNING "OPTIMUS."
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1—5000/2500 AMPERE, 8/16 VOLT, ELECTRIC PRODUCTS, 25° C.
1—5000/2500 AMPERE, 9/18 VOLT, COLUMBIA.
1—5000/2500 AMPERE, 6/12 VOLT, EAGER.
1—5000/2500 AMPERE, 6/12 VOLT, CHANDEYSSON, 25° C.
1—4000/2000 AMPERE, 6/12 VOLT, CHANDEYSSON.
1—3000/1500 AMPERE, 6/12 VOLT, COLUMBIA, Synchronous
1—2000/1000 AMPERE, 8/16 VOLT, ELECTRIC PRODUCTS.
1—2000/1000 AMPERE, 6/12 VOLT, CHANDEYSSON.
1—2000/1000 AMPERE, 6/12 VOLT, MUNNING "OPTIMUS."

ANODIZERS

1—4000 AMPERE, 40 VOLT, CHANDEYSSON, Exciter-in-head.
2—1000 AMPERE, 30 VOLT, IDEAL, Exciter-in-head.
1—1000 AMPERE, 40 VOLT, CHANDEYSSON, 25° C.
1—400 AMPERE, 40 VOLT, M. G. C., Exciter-in-head.

RECTIFIERS

2—BRAND NEW BASIC RECTIFIERS, 1500/750 amperes, 6/12 volts. Special Price: $750.00 each. Separate Voltage Controls Available.
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1—GREEN SELECTOPLATER, 1800 AMPERE, 12 VOLT.
1—UDYLITE-MALLORY, 1500/750 AMPERE, 6/12 VOLT.

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3 HP, 5 HP, 7½ HP and 10 HP, DIVINE, HAMMOND, M. G. C., GARDNER, TWIN 5 HP and TWIN 7½ HP ROME, and other popular makes.

SPECIAL

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4—24" and 30" ROBBINS & MYERS 2-SPEED VENTILATING FANS.
2—DIVINE & PORTER CABLE BACK STAND IDLERS.
1—ALMCO DB-8 TWO-COMPARTMENT 60" x 30" HORIZONTAL TUMBLING BARREL. Unlined, with motorized shaker and unloading pan, like new (can be lined).

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CINCINNATI: Thomas J. Whitehead

DAYTON: G. D. Comer

DETROIT: Charles E. Baxter

LOS ANGELES: E. H. Bowlds, Sidney F. Hill, William B. Johnson, Andrew J. Osprung, William C. Pollard, Herbert Zagor

PHILADELPHIA: David K. Robson

ST. JOSEPH VALLEY: James Mokman

SAN FRANCISCO: Edward J. Moon

SYRACUSE: Ivan V. Hood, Duane G. Lawton, Frank Quackenbush, John Ventura

WATERBURY: George Dietz

Suspensions

CINCINNATI: Frank L. Bone, Lewis French, William J. Ryan, Elmer Sams, Richard Schmidt

DAYTON: Ernest D. Cummins

ST. LOUIS: R. F. Schonlau

SYRACUSE: Gerald W. Backus, Lou Braemer, A. David Douglas, Stephen J. Egged, Charles Loundsbury, Alfred Marzocchi, Willard F. Moore, Robert C. Taylor, Thomas Taylor

Deaths

NEW YORK: Benjamin S. Flug

ST. LOUIS: John Marshall, Rees Ricket

BRANCH NEWS

(Continued from page 929)

SYDNEY BRANCH

The technical session of the 90th general meeting held at the Trust Building, King and Castlereagh Streets, Sydney, was conducted by Mr. SPENCER MOON.

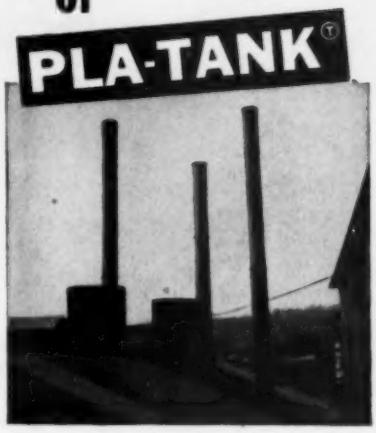
The talk by Mr. Moon dealt with many cleaners and cleaning cycles. Solvent, vapour, alkaline, electric and soak cleaners were the main topic of the lecture, and many useful points were gained from this discussion.

Quite a number of questions were fired at the speaker as could be expected in talking about a subject such as was chosen.

A vote of thanks was moved in which the speaker was complimented on the nature of his talk and the facts that were given to all present.

B. BRIDGEMENT, *Secretary-Treasurer*

FUME STACKS of PLA-TANK®



Day by day, more and more PLA-TANK Stacks go to work helping to solve corrosion problems.

PLA-TANK STACKS
are manufactured from long-life resin-bonded glass fiber.

PLA-TANK STACKS
are resistant to a wide variety of fumes and temperatures. Not affected by extremes in weather.

PLA-TANK STACKS
are light in weight, relieve danger of collapsing and sagging roofs; need less support. Save on handling, freight and shipping charges.

PLA-TANK STACKS
are easy to install, require less rigging.

PLA-TANK STACKS
are competitively priced with other corrosion-resistant materials.

PLA-TANK STACKS
are available now in diameters to 54".

PLA-TANK STACKS
are the answer to your needs for many fume exhaust jobs now on your drawing boards or for replacements in existing systems.

Write for free data file sheet

P-11

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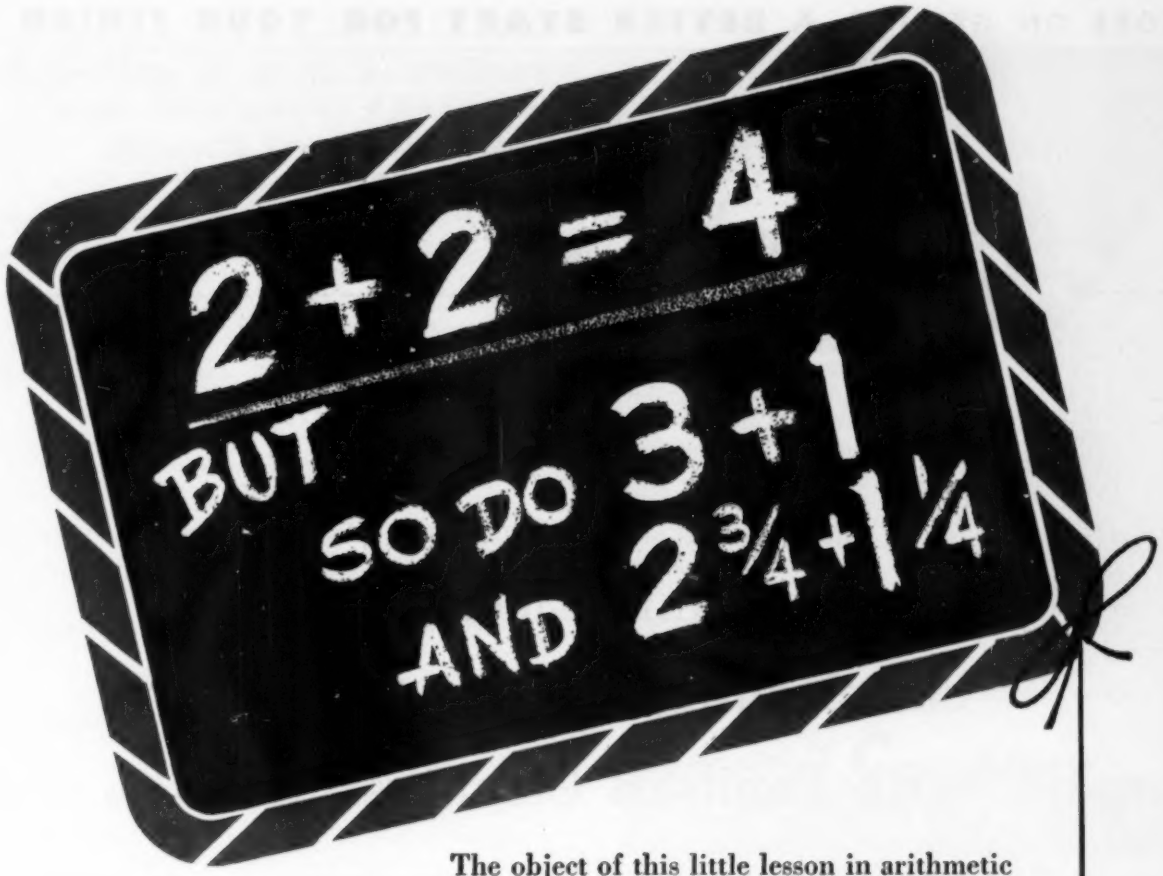

The object of this little lesson in arithmetic is to prove that there are more ways than one to come to a conclusion. But, when it narrows down to Rectifiers, there is only one conclusion you can make. And that is... Green Rectifiers are unbeatable for quality, performance, and service.

IF YOU WANT THE BEST... Buy Green!

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SELECTED RECTIFIERS AND ALL TYPES OF RECTIFIER EQUIPMENT

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RECTIFIER ENGINEERS

SYLVANIA

Lighting, Electronics, Radio, Television.
Sylvania Electric Products Inc.

How Sylvania Electric cut cleaning costs 52.8% with Pennsalt Cleaners

A striking, although not unusual, example of the value of Pennsalt Cleaners comes from the Radio and Television Division of Sylvania Electric Products Inc.

In its Buffalo plant, this Division stamps out thousands of steel radio and TV chassis and other miscellaneous parts every day which are then zinc plated. After a survey of the plant, the local Pennsalt representative suggested that two Pennsalt Cleaners could definitely reduce cleaning costs in the plating operation.

After a test, the Pennsalt cleaners were adopted, and these were the results of the change:

1. Total consumption of cleaners was reduced in each four-week period from 2700 lbs. to 2140 lbs. including make-up schedules.

2. Previous cleaners cost $432.00 a month. The Pennsalt products run $204.78 a month—*a 52.8% saving.*

3. The Pennsalt Cleaners removed stamping oils and shop grime with equal or greater effectiveness than the previous cleaners and were in every other way completely satisfactory.

Here is a brief introduction to the two products that performed this notable cost-cutting feat: the first Pennsalt Cleaner is a concentrated, extra-heavy duty soak or immersion tank alkaline cleaner with exceptional emulsifying powers. The second Pennsalt Cleaner is an alkaline electrolytic cleaner specially compounded for removal of heavy smut deposits when used in reverse cleaning cycle.

The extensive Pennsalt Cleaner line includes products for virtually every type cleaning operation, and Pennsalt specialists have vast experience in properly applying them.

No matter how effective or economical you believe *your* present cleaners to be, there is a very good chance that a saving similar to Sylvania's can be made in your plant with Pennsalt Cleaners! Contact your Pennsalt representative today or write:

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Secretary.....The Executive Secretary

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address: Room 30, 17 Currie Street, Adelaide, S. A., Australia

ALLENTOWN-READING meets third Wednesday of each month in Scotty's Anchorage, Second and Main Streets, Emmaus, Pa. Secretary-Treasurer, Norman H. Miller, New Berlinsville, Pa. Research Finance Committee Chairman, Malcolm G. Merkle, c/o General Electric Company, 1801 S. 12th Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Asaf A. Benderly, 1829 Summit Place, N. W., Washington 9, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research Finance Committee Chairman, Louis V. Gagnon, 53 High Street, Natick, Mass.

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Robert G. Parker, 25 Beverly Road, Trumbull 58, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary and Research Finance Committee Chairman, B. P. Fortin, Jr., 209 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 6 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago 22, Ill. Research Finance Committee Chairman, Charles Geldzahler, c/o Platers' Technical Service, Inc., 509 S. Wabash Avenue, Chicago 9, Ill.

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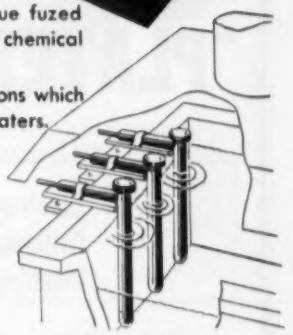
This permits use under conditions which inhibit the use of other type heaters.



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- *High rate of heat transfer*
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- *Compact design*

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Anodes, All Types
Nickel Sulphate
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Warehouse Stocks Maintained

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CANTON, OHIO

CINCINNATI meets fourth Wednesday of each month at 7:30 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, William Young, 7124 Montgomery Road, Cincinnati 36, Ohio. Research Finance Committee Chairman, C. R. Sorber, 2004 Connecticut Avenue, Cincinnati 24, Ohio.

CLEVELAND meets first Friday of each month in Hotel Carter at 8 P. M. Secretary-Treasurer, A. J. Lupien, 4408 Carnegie Avenue, Cleveland 3, Ohio. Research Finance Committee Chairman, to be appointed.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, Harry L. Moore, 505 King Avenue, Columbus 1, Ohio. Research Finance Committee Chairman, to be appointed.

DALLAS-FORT WORTH. Secretary-Treasurer, A. C. Fricke, 1415 Plowman Avenue, Dallas 8, Texas.

DAYTON meets second Wednesday of each month in the Biltmore. Secretary, John Easton, 641 Fairachers Drive, Dayton 9, Ohio. Research Finance Committee Chairman to be appointed.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, R. J. Racine, c/o Wyandotte Chemicals Corporation, Wyandotte, Mich. Research Finance Committee Chairman. New appointment to be made.

GRAND RAPIDS meets second Friday of each month at Fingers Restaurant at 7 P. M. for dinner; educational session at 8:15. Secretary, John Dykstra, 720 Delaware, S. E., Grand Rapids, Mich.

HAMILTON BRANCH meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, R. Burke, c/o Swift Devices, 14 George Street, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond at 7:45 P. M. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

HOUSTON meets third Tuesday of each month at 6:30 P. M. in the Ben Milam Hotel, Houston. Secretary-Treasurer, C. A. Mattiza, P. O. Box No. 9312, Houston, Texas.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Miss Edna Rohrabaugh, 816 Robert Street, Lafayette, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Meadow Lark Inn in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. J. Bosca, 411 Third Street, Jackson, Mich. Research Finance Committee Chairman, H. McKlueen, 3617 McCain Road, Jackson, Mich.

KANSAS CITY—Secretary-Treasurer, Olin K. Bock, 5317 W. 58th Street, Mission, Kansas.

LANCASTER meets second Friday of each month at 8 P. M. September, December and April meetings are held at Hanover, York and Harrisburg, respectively; all other meetings at the Old Mill Inn, Lancaster, Pa. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium. Secretary, L. Truman Stoner, 12427 Sproul, Norwalk, Calif. Research Finance Committee Chairman, Earl Coffin, 5102 Marburn Avenue, Los Angeles 43, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, Joseph G. Sterling, 1169 Keller Avenue, Louisville, Ky. Research Finance Committee Chairman, T. K. Allison, 2502 Manchester Rd., Louisville 5, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, S. B. Pearce, G. P. O. Box 4591, Melbourne, Australia.

MILWAUKEE meets first Friday of each month in the East Room, Hotel Ambassador. Secretary-Treasurer, E. E. Piellusch, 2921 S. 90th Street, West Allis 14, Wisc. Research Finance Committee Chairman, to be appointed.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary, J. T. Reisenburg, Jr., 996 DeBullion Street, Montreal, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets third Friday of each month at 8 P. M. in Hotel Robert Treat. Secretary-Treasurer, George Wagner, Hy-Grade Electro Plating Company, 35 Fourth Street, Newark, N. J. Research Finance Committee Chairman, John Gumm, 538 Forest Street, Kearny, N. J.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in the Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, Milton Nadel, 41-15 50th Avenue, Long Island City 4, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets (unless otherwise stated). Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, to be appointed.

PITTSBURGH meets second Thursday of each month in the Avon Room of the Sheraton Hotel. Secretary, Wm. D. Wilson, 1167 Varner Road, Pittsburgh 27, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Secretary, Henry Shavier, 32 Hodges Avenue, Taunton, Mass. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

ROCHESTER meets third Monday of each month at the 40 & 8 Club, 933 University Avenue. Secretary, Edwin Wallin, 70 Peach Tree Road, Penfield, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester 10, N. Y.

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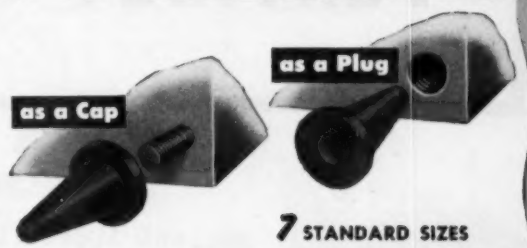

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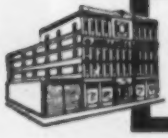

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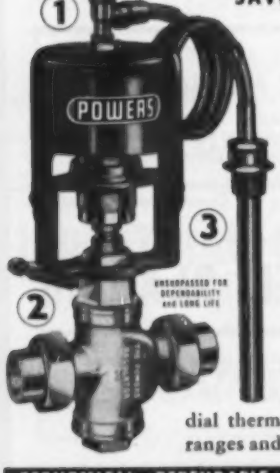

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ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Elkhart Hotel, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 739 N. College Street, South Bend 28, Ind. Research Finance Committee Chairman, Ralph Brouwer, 361 Maple Avenue, Holland, Mich.

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SYDNEY, AUSTRALIA meets second Thursday of each month at 7:30 P. M. in the Trust Building, King and Castlereagh Streets. Secretary-Treasurer, B. Bridgement, 19 Adelaide Street, Belmore, Sydney, N. S. W., Australia.

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TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Robert L. Edwards, 1106 Dovercourt Road, Toronto, Ont., Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 6:30 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Company, 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, to be appointed.

WATERBURY meets second Thursday of each month in Elton Hotel. Dinner, 6:30 P. M.; meeting, 8 P. M. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Drawer B, Cheshire, Conn.

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